THE OHIO JOURNAL OF SCIENCE

VOL. L JULY 1950 No. 4

CONSERVATION IN THEORY AND PRACTICE[1]

PAUL B. SEARS,
Oberlin College, Oberlin, Ohio

More than one speaker, I suspect, has submitted a title under stress, and then when the grim business of preparation began, has opened his dictionary to see exactly what he is to talk about. Following this precedent, I find half a dozen meanings for the word "theory," and more than three times as many for the word "practice." Curiously, I find, too, that when these words are used together, it is in an antagonistic sense. In such instances it is the word "theory" which suffers, for it is used to mean—not a body of principles—but speculation and guesswork. Since our civilization accepts the achievement of power, whether social, political, or economic, as a practical accomplishment and a commendable one, any criticism or opposition can be damned out of hand as being theoretical, speculative, irresponsible, and visionary. Not to be practical in the accepted sense can be a very bad thing indeed, and to call anyone a theorist seems to dispose of him effectively.

For a long time those excellent fellows, the sport fishermen, were convinced that poor fishing could be remedied by closed seasons, catch limits, and the breeding of fish in hatcheries. Any suggestion to the contrary was dismissed as theory. Then gradually fishermen began to learn of the importance of clean water as a habitat for fish, of the enormous reproductive power of fish in good environment, and of the extent to which our inland waters have been polluted by sewage, industrial waste, and silt from eroding farm lands.

The resulting protest has taken on the character of a minor political earthquake. Sportsmen have mobilized to demand that our rivers and lakes be made clear again. Now this is an expensive request to those who have so long used our streams as open sewers. As a matter of fact they have a reasonable and honorable defense, for the public which has so long tolerated this abuse is as guilty as they and should be made to shoulder part of the burden. But the interesting fact is that in the heat of battle the first defense was to reach for a deadly weapon—the word "theory." The fishermen who demanded an end to pollution were called "theorists," although they include men from all walks of life. It was amusing to see, in the newspapers, a fair cross-section of our population thus labelled, on the bland assumption that if you call a man a "theorist" you are effectively rid of him.

Even those who should know better fall for this. I recall a congressman who had considerable respect for science. One day he asked me point blank if it would not be a good thing to prohibit the growing of wheat in the semi-arid country west of the 100th meridian where the Dust-bowl lies. Knowing the mischief which had resulted from this practice, it was a great temptation to say "Yes, of course" and have done with it. But as a scientist I was familiar with the diversity of soils and other conditions in this area. In all honesty, I had to qualify my answer. Unfortunately my host was not a scientist. He was a politician, though an enlightened one. He couldn't be bothered with details, however simply they were

[1]Presidential address delivered before the Ohio Academy of Science, at Capital University, Columbus, Ohio, April 28, 1950.

presented. He wanted an answer in the good Christian tradition of "Yea, yea, and nay, nay," and held forth at length on the need for a lexicon which would translate science into black and white for the benefit of his kind.

Now this particular congressman had performed a considerable public service by coining the word "gobbledegook" in protest against the obscure and pretentious language that had recently became so popular in government documents—"directives," "implementations," and the like. But there is a vast difference between inflated, involved, and misleading language and the plain description of a complicated scientific situation. For all his good intentions my friend was too impatient to make the distinction. In objecting to scientists not because their theories were wrong, but because they were too complex, he allied himself with his political enemies who would gladly discredit theory because the truth might interfere with their personal schemes.

It is a curious fact that while the average man can be readily prejudiced against theory as something impractical and speculative, he has a great appetite for speculation, and a great weakness for speculative theories as a guide in his most common actions. Countless millions have shaped their conduct and established their values in conformity with intuitive systems of belief which not only have not been, but cannot be, tested with the same simple rigor that applies to scientific theory.

Even that most ruthlessly practical and realistic of conquerors, Ghenghis Khan, who tolerated all religious faiths among those spared by his sword, considered it necessary to formulate a system which he called the Yassa—some twenty-two statements of spiritual and practical belief. The activities of Hitler along this line are too recent to require description, and were carried to the absurd point where they ultimately crippled vital scientific research in Germany. Even Soviet Russia, which has exalted science into a religion, is allowing the party line to determine what is true and false in genetics, to say nothing of art and literature. By this view biological truth is no longer a matter of open inquiry and free agreement among scientists of all nations. To my mind this is the most tragic and decisive symptom of a barrier between East and West. If the same kind of nonsense spread to the physical sciences, we would benefit by the resulting paralysis in Russia, as we did in the case of Hitler, but I doubt if the Kremlin will go that far.

Actually there are signs of a reaction against science in our own civilization. Certainly there is revolt against scientists and scientism. It began some years ago in England with the proposal for a science holiday, to permit society to catch up with technological change. It has been continued vigorously by Hutchins and his disciples in the Great Books movement. True, Hutchins does insist on human values and the need for intelligence, and he has given ample financial support to scientific research at Chicago. But he has some of the qualities of a highly literate, sharp-tongued, and extremely clever demagogue. Within the month I heard him condemn the social scientists for teaching trash; and when asked what he meant by trash, he replied "facts!"

On the best-seller list just now is Standen's new book, "Science is a Sacred Cow"—another hint of the gathering reaction. With devastating flippancy it points out the limitations of science and of scientists. This is an oft-told tale which the scientist can well afford to read again. But if it coddles the popular delusion that there are short cuts to natural truths, it can do mischief. I must admit that there are scientists who are uneducated, unaware of their premises, naive in their notions of method and of truth. But this will hardly stand as a mass indictment, with physicists, for example, concerned as they are at the use to which their discoveries have been put.

If the practical man has a contempt for theory I suspect it to be a front for his fear, and the more vehement his expression of contempt, the greater his fear of

the power which lies in theory. Assuredly there is no more powerful agency at man's disposal than theory. Theory is something to be afraid of, unless it favors his immediate schemes.

The practical man, of course, is glad to use such bits of theory as he needs for his purpose. I once met a gentleman who has on his payroll some of the ablest theorists in the country—he cannot do without them. But I found him quite uninterested in discussing an ancestor of his who had some stimulating ideas on the subject of industry, agriculture and society. After all, great grandfather had raised some very uncomfortable as well as important questions.

The current wave of dam building illustrates the tendency to limit the use of theory to what seems at the time practically advantageous, while ignoring the broader aspects of theory which are not immediately convenient. The effect can be serious. Just recently two dams which seemed to comply with all the necessary requirements had to be breached to avoid the danger of disastrous floods downstream. The designer had taken no account of stream-gauge data in the watershed, though he followed the rules in everything else. A trained hydrologist fortunately caught the defect in time to save lives and property. Both men were using theory, but that of the first was too circumscribed.

I recall, with no pleasure whatsoever, being invited to a meeting to promote the Grand River dam in Oklahoma, later built at great expense. I was all in favor of keeping as much transient water in Oklahoma as possible, but took pains to explain that land-use patterns in the watershed would have to be studied, perhaps modified if the reservoir were to be kept from silting and the dam from becoming a flood menace. The promoters were much incensed and made that fact only too clear. They got rid of me, got the money, and built the dam. Since the dam was completed there has been at least one serious flood, and so much siltation that farmers are being begged to practice soil conservation. The practical boys got their dam without undue delay, but theory caught up with them. I have never seen the dam. No doubt it complies beautifully with all of the requirements of dynamic theory. But this is dismembered theory, restricted in scope and worked out without relation to the broader aspects of the problem. It is an instance of the precise application of science to detail, and the grossest empiricism with respect to the broad setting.

One may sail a lake, or skirt the edge of a coast without considering latitude and longitude. The location or even the existence of the poles and of other continents need not concern him. But when mariners venture on the broad ocean they must know that earth is a sphere and be able to locate themselves with mathematical precision on this sphere. The voyages of Columbus were quickly followed by the perfection of quadrant and chronometer, with consequent rapid advance in astronomy and physics. Theory, in truth, is not in antagonism to practice, but inseparable from it. It is on this basis that I wish to discuss theory and practice in conservation, conceiving theory not as speculation but as a body of principles.

To that end, I shall first summarize the situation that now exists with respect to our resources, then develop briefly the principles upon which any sound future action should be based.

To the Europeans who settled what is now the United States, resources seemed inexhaustible. Andrew Jackson, in one of his Thanksgiving Proclamations, said they were inexhaustible, and that we would never have unemployment. Before that, Jefferson's purchase of Louisiana had been condemned as piling too much on top of plenty, while later Alaska was to be referred to as Seward's Folly.

And it was true that some resources which today are of great value—notably trees, water, and wildlife—were honestly regarded as obstacles against civilization, to be got rid of as speedily as possible. The log-burnings so well described by Conrad Richter, the gigantic slaughter of bison during the 70's, and the reckless

drainage by ditch, roadway, and tile all stemmed from the desire to put more land to plow or pasture.

There was no restraining concept of the need for a balance of nature, least of all any notion that man might be a part of nature and thus dependent upon maintaining such a balance. Poor Richard's sayings were scripture to our young nation. But somehow we paid no heed to one of the most important and profound statements that Dr. Benjamin Franklin ever made. This philosopher had studied the rate of population increase in the colonies, anticipating Malthus by nearly fifty years. As he put it, "There is, in short, no bound to the prolific nature of plants or animals, but what is made by their crowding and interfering with each other's means of subsistence."

He failed to say "plants, animals, or men" and was perhaps too discreet to say "plants, men, and other animals." After all, Lord Monboddo's suggestion that human beings had once worn tails was considered outrageous, while the religious dogma of original sin took care of many complications which arose from the fact that our own species has a long pre-civilized and a longer prehuman past. Why call man an animal? The earth and the fulness thereof might be God's but there was a general feeling that man had full power of attorney.

The medieval Church had held that economic behavior was very much its business. Individuals guilty of usury and greed were tried in ecclesiastical courts. The Reformation changed all that, and so destroyed the chance that wanton waste of resources might eventually have come to be regarded as a spiritual offense. This is actually the position of oriental Taoist belief, which regards violence against nature and abuse of the earth as a sin, quite as much as violence against man. But the Western World had not undergone the suffering of the crowded Orient and did not realize that, sin or not, the abuse of nature would ultimately react against man in a very practical way. In theological language, it was not yet ready for this revelation. Modern science is having to supply what religious insight missed.

With the divorce of religion from economics, the accepted standards of behavior became simply an extension of the rule "Finders keepers; losers weepers." The consequence of this philosophy is shown by the history of a single word "exploitation." To begin with, this was a perfectly respectable term, as it still is among engineers. Literally it means unfolding, the turning to practical account of anything. But presently it came to mean selfish use. And today it is a pungent term of condemnation in the general mind. This is no accident. One has only to read Angie Debo's account of the frightful waste of gas and oil resulting from the early scramble for quick profits in the Southwest to know why exploitation has become an evil word. It is only fair to say that not the technicians, but those who hired them were primarily to blame.

It is hard to measure honestly what this attitude has cost us and I for one am less concerned to cry over spilt milk than to undo what mischief we can and get started on the right track. The Conservation Foundation has recently published a report to Industry which graphically appraises the present state of our resources. The same foundation is today engaged in a nationwide water survey and a worldwide report on soil. The Soil Conservation Service, Forest Service, Fish and Wildlife Service, all have marshalled disquieting figures which seem to stand up, despite some criticism.

Some of this criticism comes from surprising sources. Thus an exceptionally able senior member of one of the older scientific bureaus of the U. S. Department of Agriculture has been severely critical of our concern over soil erosion. He calls erosion a symptom rather than a cause of poor rural economy, and says, correctly enough, that erosion is only one source of soil deterioration. But by inference he disparages its importance. Because his words have been eagerly quoted by those who would play down the whole conservation movement, I think it fair to point

out that he represents a group whose word was law in scientific agriculture until the whole erosion problem blew up in their faces. Had that group been psychologically and technically prepared to meet the emergency, would two Presidents—one a Republican and the other a Democrat—have found it necessary to develop an entirely new agency—the Soil Conservation Service? I doubt it.

Among the many foresters I know, I have found only one who is complacent about our timber supply, saying, "We have plenty of trees." I am sorry to have to point out that he is a marked man in the profession, having no connection with the growing and management of forests, but close ties with those who exploit them. So far as wildlife estimates are concerned, I know of no criticism deserving attention.

Even the best of national inventories are based on aggregates of local samples, and no skill of mathematical manipulation is able to give greater accuracy than that of the original sampling. For this reason I am inclined to lay considerable stress on my own detailed observations in the field. I have worked in all but three states of the Union—Washington, Oregon, and Arizona—as well as the province of Ontario and much of Mexico.

The net result of my observations can be stated very briefly: *efficient land use, that conserves and improves the capacity of land to produce, is the exception rather than the rule.* To a trained ecologist poor land use is as obvious as the symptoms of disease to a trained physician, while good land use stands out in notable contrast. True, money is often being made from poor land use, but if so, it is at the cost of capital investment. Even so cautious an authority as Dr. Robert Salter has warned that the great increases in yield from hybrid corn are largely obtained at the cost of soil deterioration. The same statement can be made of such other cash crops as soy beans, tobacco, and cotton.

There can be no question that a marked improvement has been under way for the past fifteen years. But neither is there any question that this improvement has been most vigorous, not on the best farming lands, but on the poorer. It is the hill counties in Ohio and in the South which have taken the lead in good conservation practice, while the rich level lands of the Black Swamp and the cotton belt continue to waste away.

I can, of course, speak most definitely of Lorain County where I have been living for the past twelve years. This county receives about forty inches of rainfall per year, over 4,000 tons per acre, yet a substantial proportion of farmers are buying city water. This county has a minimum of well managed mixed legume pasture, and far too many soy bean and corn fields left bare through the winter months. There is little systematic return of organic matter to the soil, and practically no trash farming which would increase water absorption. Our studies show that pastured woodlots, with their trampled soil, suffer heavily from summer dryness. This condition is intensified by the fact that absence of undergrowth permits leaves to be blown away, instead of rotting into absorbent mulch.

We have found that about 20 per cent of the county drains directly into highway ditches. Except for the rare cases where the drainage slope is covered with improved pasture or protected woodland, this represents a heavy discount on the annual rainfall.

The streams of the county suffer from pollution and uneven flow, with resultant damage to fishing. With respect to one stream, we know that deterioration can be traced to clearing the headwater forests and thickets. Assuming this relation to be general, we have mapped woodlots and stream sources. We find some 800 woodlots (mostly grazed) and about 400 stream sources; but of this number only 36 stream sources are wooded. This is a meager 10 per cent guarantee of stable stream flow.

Such, in brief, are conditions as of today in a fairly prosperous and respectable

agricultural county which no one thinks of as marginal. In happy contrast are two noted Ohio farms, those of Louis Bromfield in Richland County, and Cosmas Blubaugh in Knox County. Both are models of intelligent ecological treatment. That of Bromfield is thoroughly analyzed and discussed in his latest book, "Out of the Earth," and I am inclined to agree with Russell Lord that this will be one of the most important agricultural publications of recent years. Bromfield has put his land to rich meadow, whose grass and legumes are used for pasture, hay, and ensilage. Corn has been eliminated and small grains confined to the necessary minimum of oats and barley required for occasional seeding of meadows. Under a new plan oats and barley are added to the ensilage, enhancing its nutrient qualities. The deep rooting meadow plants tap the subsoil minerals, while a system of rough tillage conserves moisture and organic matter. I have myself confirmed the benefits of this system to land, water, and livestock, and am prepared to accept Mr. Bromfield's statement that he is producing meat and milk at a heavy saving. Of great importance is the claim that animals and plants are far healthier than under the old system of row crops and grain farming. This statement is in accord with much testimony from other sources and deserves the most careful scientific check.

The Bromfield farm is an individual enterprise; but there are examples of community patterns of excellent land-use, long antedating the time of science. Such are the Pennsylvania Dutch farms, the Igorote terraces between Manila and Baguio, and some of the pre-Conquest areas in central Mexico, of which mere traces persist. At best these are few in number and meager in extent as compared to the general pattern of exploitation, world around. Yet they serve to show that peace between man and nature is possible.

Now these ancient systems of good land use were worked out through generations by the costliest, most painful trial and error. On the other hand Mr. Bromfield, making use of scientific insight, was able to establish a successful system in less than ten years. For those who do not understand the advantages of scientific theory over trial and error I would recommend reading first Mr. Bromfield's "Out of the Earth" and then a recent book by George Reeves called "A Man from South Dakota." Reeves, trained in journalism, a born gambler and a hard worker, went at the business of developing his South Dakota ranch as though he were playing roulette. Unquestionably he had very difficult conditions under which to work, but at the end of twenty-four years he still seems not to sense that it is possible to conquer nature only on her own terms. He had studied some science, true, but nowhere seems to have learned that any landscape, whether farm or river valley, is a great organic entity which must operate in accordance with the principles of the balance of nature. His experience is in powerful contrast to that of Mr. Bromfield.

This brings us finally to the question of what principles underlie the wise use and care of natural resources. First I should place the fact that any area with its resources and inhabitants is an expression of energy. This energy comes primarily from the sun, is fixed by green plants in the form of organic compounds, and thereafter channeled through food chains to all forms of life present. In the course of this channeling the laws of the conservation of energy apply as relentlessly as in any laboratory experiment or industrial process. It is entirely possible for a trained ecologist to judge how efficiently the energy is being transformed and used in any habitat. He can read the landscape as a banker reads a financial statement.

Let us suppose that stubble is being burned. This results in a complete release of all energy and reduction of material to inorganic state. On the other hand if plant and animal materials undergo natural decomposition countless forms of life take part in the slow, step by step release of energy. This has two consequences. Each step affords subsistence to a particular set of organisms. The more gradual

the change, the larger the number of possible niches which can be filled by appropriate forms of plant and animal life. Each in turn performs a role in relation to the whole community, changing it and in general helping better to organize it to sustain future generations of living things. One may observe this process in an abandoned field returning to forest or a neglected roadway going back to prairie.

As time goes on any area tends to build up to the point where it makes the most efficient use possible of solar energy and the raw materials of earth and air. This is the type of virgin habitat which Europeans entered when they settled North America. It is still the norm or standard towards which good land use should direct its aim. Too often, as we have seen, the effect of human occupation is to disrupt completely this chain of events and not substitute anything constructive for it.

Finally, our own species is related to the rest of nature largely through its socially sanctioned forms of behavior. It may happen, as it did with the Pennsylvania Dutch, that such behavior was arrived at through the long course of trial and error. With us, however, the problem is to modify our behavior in the light of scientific knowledge. This clearly calls for a wide understanding of the body of principles which lie back of sound land use and for making those principles a matter of social sanction. It is at this point that the scientist must enlighten those who formulate public opinion and establish standards of behavior.

Technically, these are the artists, poets, writers and publicists of our civilization, to whom falls the task of dramatizing the truth as they see it. This was the role of John Steinbeck when he wrote "Grapes of Wrath." Unfortunately, he was at least two removes from the source of truth, and while he stirred up public opinion, the net effect had more to do with reforming transient camps in California than with restoring the soil in Oklahoma, whose abuse was the physical basis of his tragedy.

Edmund Sinnott has given us a valuable clue in his presidential address to the American Association for the Advancement of Science. He spoke on the topic, "Millions of Scientists," pointing out the opportunity for widespread social participation in science. His view has been justified, for example, by co-operative land use surveys in England and this country. The process can be much more widely extended. Such co-operation in science would bring home, as nothing else can, those principles which must guide our civilization if it is to endure.

And to his suggestion I would add another, which I think is inherent in our democratic philosophy. Call it "Millions of Interpreters" if you like. As each individual comes better to understand the principles of which I have spoken, he can, without waiting for the Steinbecks, express the importance of what he knows and so play his part in molding public opinion and establishing new values.

I can testify that just such a process is now under way. Friends of the Land, the Izaak Walton League, American Forestry Association (and here in Ohio our vigorous Ohio Forestry Association), countless Garden Clubs, and many other lay organizations are learning the truth and telling it.

The conservation movement may have a long and difficult way ahead, but it has crossed the divide.

THE SPECIAL SYMPOSIUM ON CONSERVATION PRESENTED AT THE FIFTY-NINTH ANNUAL MEETING OF THE OHIO ACADEMY OF SCIENCE

CHARLES A. DAMBACH,
The Ohio State University,
Columbus, Ohio

Progress toward scientific management of our natural resources although discouragingly slow at times has none-the-less been remarkably rapid during the past two decades. During this period the number of scientifically trained personnel employed to cope with resource problems has increased many fold and numerous important conservation projects have been completed. In our own state, for example, the number of trained workers engaged in soil, water, forest, mineral and wildlife management and research has grown from less than 50 in 1930 to approximately 250 at the present writing. During the same period such important projects as the Muskingum Watershed Conservancy District with its 14 flood control dams and 10 recreational lakes, greatly enlarged public forest programs and the organization of Soil Conservation Districts in 78 of the 88 counties in the State have been realized.

Considerable progress has also been attained in conservation education. Courses designed to awaken students to an understanding of resource problems were initiated during this period at a number of the privately supported Ohio colleges and universities and in at least three of the state supported universities. The Ohio Conservation Laboratory for prospective teachers and teachers in service was also initiated during this period. This program, conducted by the College of Education of the Ohio State University in co-operation with the State Department of Education and the Ohio Division of Wildlife has provided training to many elementary and secondary school teachers who have established centers of conservation teaching in both large and small school systems in the State.

Although these and many other accomplishments have been attained it is readily apparent that much yet remains to be done. We have made progress on only some of our problems while on others we are still falling behind. Despite notable advances in soil conservation for example we are for the state as a whole still carrying on a depleting type of agriculture. Probably not over 20 per cent of Ohio farms are managed on a self-sustaining basis in so far as soil resources are concerned. While progress is being made on some fronts new problems continue to develop. The growth of the chemical industry in recent years has for example introduced new problems due to the resulting waste products emptied into our already polluted streams. Wildlife management problems too have become more complex because of the ever growing army of hunters and fishermen who seek an equitable share of the wildlife crop produced on farms and the meager area of publicly owned land in the state.

One of our major problems is to so co-ordinate the efforts of the various agencies established to work on conservation programs that the maximum good may be accomplished with the limited funds at their disposal. The recent Ohio Legislature had this objective in view when it enacted legislation establishing a Department of Natural Resources. " . . . and to bring into that department, as divisions thereof, the various state agencies engaged in conservation of natural resources and to provide for the correlation of the work and activities within the department so as to avoid and eliminate unnecessary duplications of effort and overlapping of functions . . . "

This legislation brought into legal status on August 11, 1949, the first unified conservation department in the state and placed Ohio among the select group of states which now handle their resource problems in this manner.

The conservation symposium conducted at the recent annual meeting of the Ohio Academy of Science was planned by the Conservation Committee to acquaint members of the Academy and the general public with current conservation problems in Ohio and the programs of the agencies charged with responsibility for their study and management. Special emphasis was given to the administrative organization of the newly created Department of Natural Resources and to the program, problems and policies of the divisions of Geological Survey and Water within that department. The papers presented at this symposium are herein published as a means of further disseminating the information presented. It is hoped that similar symposia may be conducted at subsequent meetings of the Academy so that the work of the remaining divisions of the Department and of other conservation agencies in the state may become better known.

ANNUAL MEETING

OF THE

AMERICAN INSTITUTE OF BIOLOGICAL SCIENCE

IN COLUMBUS, OHIO, AND THE OHIO STATE UNIVERSITY

SEPTEMBER 11 – 12 – 13, 1950

The following Biological Societies will present programs at the A. I. B. S. Meeting:

American Bryological Society
American Fern Society
American Society for Horticultural Science
American Society for Plant Physiologists
American Society for Human Genetics
American Society of Lymnology and Oceanography
American Society of Naturalists
American Society of Plant Taxonomists
Botanical Society of America
Ecological Society of America
Genetics Society of America
Mycological Society of America
Phycological Society of America
Society for the Study of Evolution
Society of Industrial Microbiologists

THE SEMI-CENTENNIAL OF GENETICS

In Celebration, the Genetics Society of America is preparing a special program for the Columbus Meeting

All members, of Biological Societies not planning programs for the A. I. B. S. meeting, are cordially invited to attend the Columbus Convention.

PROGRAM, RESPONSIBILITIES, AND PROBLEMS OF THE NEW OHIO DEPARTMENT OF NATURAL RESOURCES

A. W. MARION, Director,
Columbus, Ohio

Appreciation is expressed for this opportunity to present to the Ohio Academy of Science certain factual information regarding the recently unified Department of Natural Resources here in our own State of Ohio. I am aware that many individuals who hold membership in the Academy contributed a great deal of their own time and effort toward the creation of this unified conservation program.

The movement to create an integrated state department, embracing all forms of resource conservation, has actually been in the making for nearly a decade. The idea had numerous, scattered proponents even earlier than that; but within the last half-dozen years, the idea really took hold and flourished to such an extent that legislation was introduced in three successive sessions of the Ohio General Assembly, relative to the creation of a unified Natural Resources Department.

The Bill which was finally enacted into law was Senate Bill No. 13, of the last General Assembly, and the law became operative on August 11, 1949.

It is perfectly safe to say that when the Bill was finally passed, probably no one was completely satisfied with the enacted version, although most Ohioans believed that a start had been made in the right direction. At this point, let me say that after nearly nine months of working under the provisions of the Bill, probably no one realizes more fully than I the numerous deficiencies in it; but at the same time, I have the utmost confidence that these deficiencies can be corrected, and the Bill further clarified without any serious threat to preserving the character and intent of the Act.

Numerous well qualified citizens of Ohio served on various committees to advise and review the legislation which was drafted prior to its introduction in the General Assembly. An effort was made to give persons directly interested in each of the several basic resources a voice in shaping the final broad concept of the Bill. On these committees were people interested in soil and agriculture; in geology; in wildlife problems; in parks and recreation; in the use of water from the standpoint of agriculture, industry and municipalities. Expert engineers also served on these committees. Whatever might be said for or against Senate Bill 13, it probably did reflect the attitude and the understanding of a wide range of people representing a fairly typical cross section of our entire population.

Senate Bill 13, as it became law, provided for the establishment of seven divisions in the Department of Natural Resources. These included four existing agencies and three new divisions created by the law itself. The existing agencies which were moved over into the new Department included the Division of Water, formerly listed as the Water Resources Board; the Division of Geological Survey; the Division of Forestry, formerly a section of the Agricultural Experiment Station; and the Division of Wildlife, formerly known as the Division of Conservation and Natural Resources. The three new divisions created included the Division of Beach Erosion, the Division of Lands and Soils, and the Division of Parks. A little later, I shall attempt to outline briefly for you the functions vested in each of the seven divisions.

The Natural Resources Commission established by the law, has a total of nine members. Seven of these members are appointed by the governor for seven-year terms on a staggered-term basis, and not more than four of these seven men may be members of the same political party. The other members in the Commission are designated to serve by virtue of the positions they hold—one being the Dean

of the College of Agriculture of the Ohio State University, and the other, the appointed director of Natural Resources. The director, however, is not authorized to vote on matters under consideration.

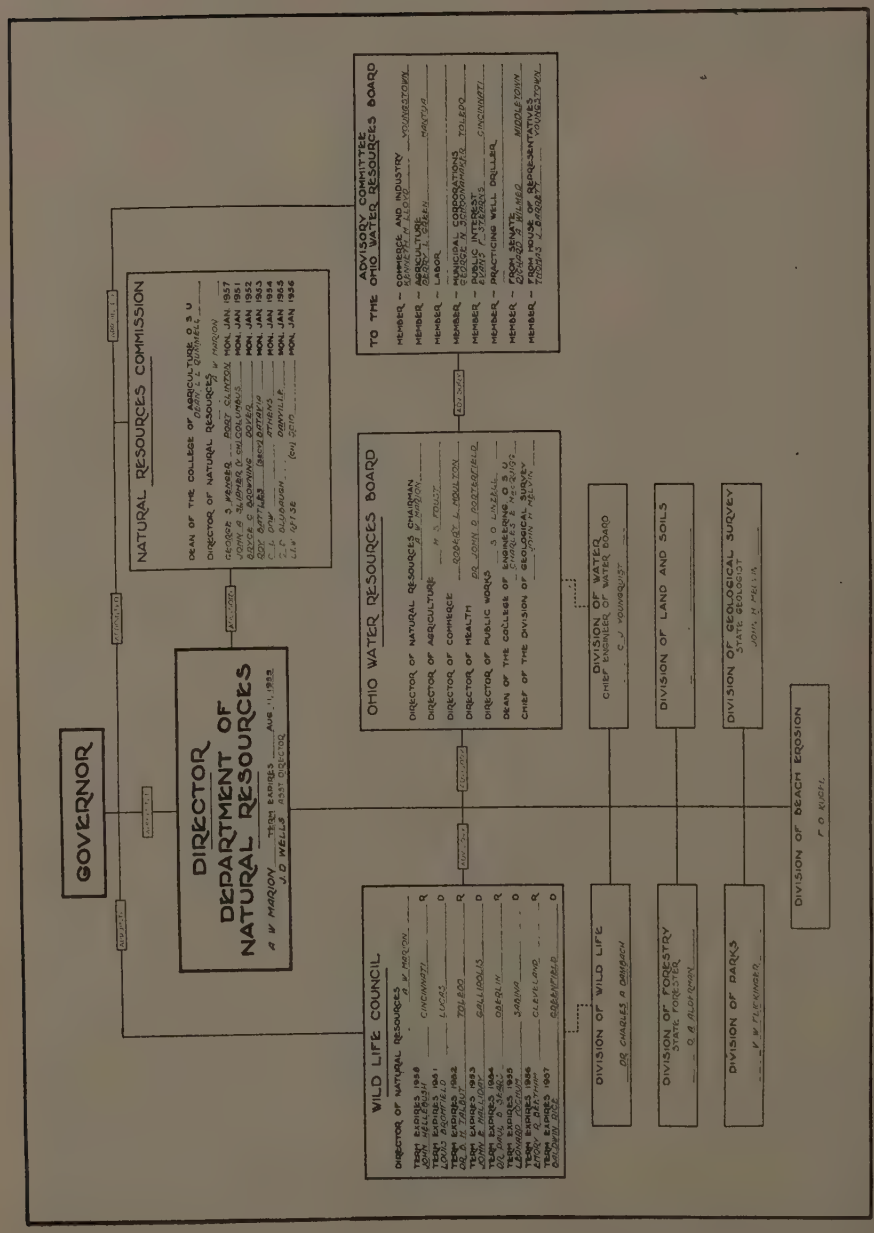
It was not my intention to enter into a discussion of personalities, but I do feel that to point out and name the initial membership of this Natural Resources Commission, will indicate to you the sincere attempt of the Governor to call upon highly qualified men to give public service, as a policy-making Board for this new, unified Department. Those who now serve on this Commission are: Mr. Roy Battles, widely known farm director of Radio Station WLW; Mr. C. D. Blubaugh, of Knox County, one of the pioneer practicing soil conservationists in the State of Ohio; Mr. Bryce C. Browning, nationally known secretary of the Muskingum Watershed Conservancy District and recognized as an authority on problems of water and forestry; Dr. C. L. Dow, Professor of Geology and Geography, of Ohio University; Mr. Lew C. Reese, one of America's outstanding industrialists whose Scio Pottery and management-labor relations has commanded national attention; Mr. John A. Slipher, widely regarded as one of the nation's outstanding practical soil technicians; and Mr. George Wenger, well-known industrialist and sportsman. The Commission exercises no administrative function but advises with and makes recommendations to the Director with regard to plans and programs for the management, development, utilization, and conservation of all of the natural resources in the State; it advises and makes recommendations on methods of co-ordinating the work of the several divisions in the Department; it may consider and make recommendations upon matters of policy which the Director may refer to it and hold public hearings on the same; and it may submit biennially to the governor such recommendations for changes in the Conservation Laws as may be deemed desirable. The members of the Commission serve without compensation, but are reimbursed for the actual and necessary expenses incurred in the performance of their duties. A majority of the membership of the Commission is necessary for a quorum.

The Bill, as it was passed, provided that there shall be a Director, appointed by the governor for a period of six years. His appointment shall be concurred in by the Natural Resources Commission and approved by the Senate.

The Bill provides that the Director shall formulate, determine, and institute the policies and programs of the Department and shall approve any contracts or agreements involving any of the seven divisions. The Director is empowered to correlate and co-ordinate the work and activities of the seven divisions so as to avoid unnecessary duplication of effort and overlapping of functions.

In addition two advisory boards were created by the Act; namely, the Wildlife Council and the Water Resources Board. There was also named an Advisory Board to the Water Resources Board, representing all affected segments of our population. The Director may create advisory boards for the rest of the Divisions, if he sees fit to do so. The Director is authorized to accept and expend gifts, devises and bequests of money, lands, and other properties on behalf of the Department or any of its divisions. He shall also have the power to publish and sell or otherwise distribute data, reports and information. With the approval of the governor, he may take action in behalf of the State for the appropriation of private property for public use, under the existing sections of the General Code, relating to such procedure. The Director of the Department shall have the right and authority to enter into co-operative or contractoral agreements with the United States Government, or any of its agencies or departments, or with any other body politic for the accomplishment of any of the purposes of the Act.

In order to maintain experienced personnel in key positions, Senate Bill 13 provides that the State Geologist, the Chief Engineer of the Water Board, the State Forester, and the Conservation Commissioner, should continue to hold their


GOVERNOR
DIRECTOR DEPARTMENT OF NATURAL RESOURCES
A W MARION TERM EXPIRES AUG 11 1938
J O WELLS ASST DIRECTOR
NATURAL RESOURCES COMMISSION
DEAN OF THE COLLEGE OF AGRICULTURE O S U
DIRECTOR OF NATURAL RESOURCES A W MARION
GEORGE S WEAVER ROSS CLINTON MON JAN 1937
JOHN A SLOMER COLUMBUS MON JAN 1941
GEORGE S CRONE JR AKRON MON JAN 1942
GUY BATTLES DEFIANCE MON JAN 1943
C.L. ORR ATHENS MON JAN 1934
E.P. CLOUGHER DANVILLE MON JAN 1935
LEE OTIS CINCINNATI MON JAN 1936
ADVISORY COMMITTEE TO THE OHIO WATER RESOURCES BOARD
MEMBER – COMMERCE AND INDUSTRY EDWARD M. FLOYD YOUNGSTOWN
MEMBER – AGRICULTURE GEORGE L. CRAIG MARTIN
MEMBER – LABOR
MEMBER – MUNICIPAL CORPORATIONS GEORGE N. SCHOONMAKER TOLEDO
MEMBER – ENGINEERS ALVIN M. STRAUSS CINCINNATI
MEMBER – PRACTICING WELL DRILLER
MEMBER – FROM SENATE EDWARD J. BLYTHE MIDDLETOWN
MEMBER – FROM HOUSE OF REPRESENTATIVES THOMAS J. BURGAN YOUNGSTOWN
OHIO WATER RESOURCES BOARD
DIRECTOR OF NATURAL RESOURCES CHAIRMAN A W MARION
DIRECTOR OF AGRICULTURE H. S. MUSSER
DIRECTOR OF COMMERCE RODNEY L. HOULTON
DIRECTOR OF HEALTH DR JOHN D. ROBERTSON
DIRECTOR OF PUBLIC WORKS S O LONSDALE
DEAN OF THE COLLEGE OF ENGINEERING O S U
CHIEF OF THE DIVISION OF GEOLOGICAL SURVEY JOHN H. NELSON
WILD LIFE COUNCIL
DIRECTOR OF NATURAL RESOURCES A W MARION
TERM EXPIRES 1938 JOHN HELLEBUSCH CINCINNATI R
TERM EXPIRES 1941 LUCAS D
TERM EXPIRES 1942 TOLEDO R
TERM EXPIRES 1943 GALLIPOLIS D
TERM EXPIRES 1944 OBERLIN R
TERM EXPIRES 1935 SABINA D
TERM EXPIRES 1936 CLEVELAND R
TERM EXPIRES 1937 COSHOCTON D
DIVISION OF WATER CHIEF ENGINEER OF WATER BOARD C J YOUNGQUIST
DIVISION OF WILD LIFE DR CHARLES A DAMBACH
DIVISION OF LAND AND SOILS
DIVISION OF FORESTRY STATE FORESTER O A ALDERMAN
DIVISION OF GEOLOGICAL SURVEY STATE GEOLOGIST JOHN H. NELSON
DIVISION OF PARKS A W TREKINKIN
DIVISION OF BEACH EROSION C O KIGER

positions as chiefs of their respective divisions after the effective date of the Act. Concerning new division chiefs for the divisions created by the Act, the law provided that these were to be appointed by the Director with the approval of the Natural Resources Commission.

To further strengthen the security of trained personnel, the law provides that any person holding a position within the classified Civil Service of the State, would be transferred to an equal position and grade in the new Department. Persons who were holding employment in the divisions or departments not previously subject to Civil Service were placed without examination, in positions commensurate with the duties, seniority and compensation of their previous employment.

I had originally thought to outline some of the work of all of the seven divisions of the Department; but since Mr. Melvin of the Geological Survey and Mr. Bernhagen, of the Division of Water, are to appear on this program and tell of the work of their agencies, I shall refrain from discussing the importance and work of these two divisions.

The Division of Beach Erosion was created for the purpose of engaging in projects and in lending co-operation to other agencies engaged in projects for the protection of the south shore of Lake Erie from the severe damage which occurs as a result of shore erosion. This work was formerly carried on under the Ohio Department of Public Works, and its program is virtually unchanged insofar as background of legal authority is concerned. One of the principal limitations with regard to the Division of Beach Erosion is the character and cost of the work involved. The laws under which this division functions, more or less restrict its projects and programs to those places along Lake Erie where public benefits are involved. Its program does not encompass the protection or rehabilitation of privately-owned lands. This division has jurisdiction and control of the submerged lands, belonging to the State under the waters of Lake Erie and the minerals they contain. The Division of Beach Erosion is headed by Mr. F. O. Kugel, a veteran engineer, who spent many years in this work with the Department of Public Works.

The Division of Parks, to quote directly from Senate Bill 13, "shall have the right, power, and duty to create, supervise, operate, protect, and maintain a system of State parks and to promote the use thereof by the public. Within 30 days after the effective date of this Act, all state properties, the major function of which is park in nature, shall be classified and transferred to the Department, except roadside parks, of the Department of Highways and lands of the Archaeological and Historical Society."

In order to understand the complexity of the problem involved in meeting the terms of the law, it is necessary to have some knowledge of Ohio's widely-scattered park system, prior to the establishment of this new Department.

A century or more ago, the State of Ohio engaged in building a great network of canals throughout the State, including feeder reservoirs for water supply. After the railroads supplanted the canals as a means of transportation, these lands and waters remained under the ownership of the State. Some of these reservoirs were continued under the management of the Department of Public Works with much of the rest of the canal system. Most of the reservoirs, however, were turned over to the former Division of Conservation, primarily, for the public recreation and the fishing values involved. Over the years, most of the desirable state-owned lands adjacent to the larger areas of water were leased to private individuals for a wide variety of uses. The State, however, retained custody of the water, itself, to permit boating and fishing and frequently the term "state park" was applied to such areas, although there was actually little park value involved.

In recent years, financed by both general revenue and fishing license funds, the former Division of Conservation had constructed a number of headwater lakes, primarily for additional public fishing waters. On most of these areas, a narrow

access strip was acquired around the edge of the lake, and occasionally a few acres of ground to permit the construction of a shelter house and related facilities. However, these, too, fell far short of meeting the accepted definition of a State park, even though they were frequently listed and publicized as such.

During the last quarter of a century, the Division of Forestry had acquired by purchase or co-operative agreement almost 150,000 acres in the State Forest System. The laws under which the Division of Forestry operated, were wisely written to permit acquisition of land not only for forest purposes, but for scenic, scientific and recreational values as well. Many of the finest potential park areas in the State thus passed into the cusotdy of the Division of Forestry. Recognizing the growing public interest and demand for outdoor recreation, this agency in recent years had advanced the development of public use facilities on the lands it operated and controlled. When Senate Bill 13 became law, these recreational facilities which had been thus far developed by the Division of Forestry were to pass over to the management and operation of the Division of Parks. There are numerous problems involved in arriving at a sensible basis for such a transfer of program and authority, since the recreational work had been developed as only one phase of a broadly integrated program of good land use on the State forest system. In other words, in most instances, the same personnel, the same supervision, and the same equipment were used to carry on the recreational program in conjunction with the general forestry program on these areas involving timber harvest, reforestation, fire control, road maintenance and similar activities.

The new Division of Parks has a tremendous problem ahead of it. It has considerable money at its disposal for the construction and development of new areas and new facilities, but it is sorely handicapped at present by lack of adequate operation and maintenance funds. The Division of Parks is directed by Mr. V. W. Flickinger, formerly the Chief of the Division of Lands and Waters of the State of Iowa. This Division has a real job ahead of it in development of a long-range program designed to meet Ohio's future park needs.

With relation to forestry in the new unified Department, the Division of Forestry was transferred from its former place with the Agricultural Experiment Station into the new Department with scracely a change in its day-to-day program. Only minor changes were made in the forestry laws of the Ohio General Code. Technical forestry research was left as a function of the Agricultural Experiment Station. Forestry had been unique among State agencies in the past, in that it had no Columbus office, its principal office being at the Wooster Experiment Station and its southern Ohio office at Chillicothe. Until expanded office facilities are available here in Columbus, this arrangement must still prevail.

The Division of Wildlife carries practically all of the programs formerly vested in the Division of Conservation and Natural Resources, except those activities formerly conducted under its Inland Lakes and Parks Section. When Senate Bill 13 was passed, it provided that the former Conservation Commission, the policy making board in the past, was to maintain its identity and be known as the Wildlife Council. Its principal function is to establish rules and regulations concerning thet aking, propagation, habitat restoration and federal projects relating to fish and game, and to advise with the Director of Natural Resources in all matters pertaining to the planning and developing of the programs and policies of the Division of Wildlife.

The law provides, as in the past, that money received from the sale of hunting and fishing licenses shall be used for the operation of the Wildlife Division, and it establishes certain maximum percentages which may be used for administration and law enforcement.

The seventh division which was authorized under Senate Bill 13, is the Division of Lands and Soil. This Division has not yet been established, and probably will

not be until we are in a position to provide it with office space, equipment, and qualified personnel. This Division is not intended to replace or to do away with any existing agency working in the field of Soil Conservation. Rather, it is intended to correlate the activities and to encourage and assist all other agencies which may be faced with problems relating to soil conservation. The primary function of this division will be to inventory the land resources of the State and to provide technical and mechanical assistance to existing Soil Conservation Districts.

While no one can safely predict what future legislatures will do, there is at this time considerable sentiment that the present Division of Reclamation in the Department of Agriculture, dealing with strip mine lands, might well come over into this new Division of Lands and Soils in the Department of Natural Resources. Such a change, of course, could only occur by legislative enactment.

SUMMARY

It will be seen from the foregoing that there is quite an elaborate legal framework now established for the new Department of Natural Resources. Yet, I believe that all of us who try to think the matter through, must recognize that while this legal framework may be both necessary and desirable, it is no guarantee in itself for the success of the new unified department. Rather, we must view it as a means toward an end, and not as the end objective in itself.

We must be broad enough, and honest enough, to recognize that it is going to take wise council, constructive long-range planning, competent sincere personnel, and a substantial amount of money, to do the things which we all know should be accomplished here in our own State.

We are currently faced with the problems incident to an increasing population. We are faced with the perpetual problem of maintaining the fertility and productiveness of our agricultural lands, and we are likewise faced with finding an intelligent answer to the problem of our growing areas of marginal and submarginal lands throughout the State. Yet, I believe that whether it happened to be Senate Bill 13, passed last year, or some other bill, passed within the next decade or so, we would ultimately have come to a similar effort to unify our thinking and action; for the present and future welfare of our citizens depends upon the conservation and wise use of our basic resources. Through the findings of science, we have come to the realization that we cannot hope to save one of our renewable resources without saving them all. Neither can we destroy any one resource without doing damage and injury to another equally important resource. Science has led the way in pointing out the affinity of soil, water and plants, upon which life itself depends.

In the last half century, we have gone far in development of the industrial and technical phases of our national economy. We have streamlined and integrated business and industry to secure greater efficiency in production, and better distribution of goods. It is inevitable that, sooner or later, we would come to the same philosophy in the management of our basic natural resources.

I believe, too, that this attempt to unify and integrate our efforts in the field of resource conservation represents another mile post along the road of our mental and spiritual progress. A hundred years ago in this country of ours, we abolished the institution of human slavery; 50 years ago, we began to pass social legislation for the protection of our less fortunate elements of population. Perhaps, this current rising interest in the welfare of our basic resources is evidence that we may be widening our spiritual horizons sufficiently to recognize that mankind does not own the earth, but that each generation, is destined to serve as a trustee of these basic resources, for generations yet to come.

I realize fully my own limitations in the tremendous work that lies ahead, and will certainly welcome help and suggestions from members of the Ohio Academy of Science.

PROGRAM, PROBLEMS, AND POLICIES CONCERNING MINERAL RESOURCES IN OHIO

JOHN H. MELVIN,
Chief, Division of Geological Survey

Twelve years before the founding of this great University, whose centennial we observe today, W. W. Mather, Ohio's first State Geologist, wrote in his report of 1838 "The primary object with the Legislature, in authorizing the Geological Survey of the State, was to develop its natural resources, with a view to their application to the economical purposes of life."

Down through the years, the program of the Survey has been based on that philosophy. It has always been a research organization, dedicated to discovering and making known scientific data on the mineral resources and geology of Ohio. Today that program remains unchanged. The staff serves the public by regular publication of reports on its findings, by letter, telegram, or telephone, and by personal interview. The Survey's extensive files of physical and chemical data, its many and varied publications and maps, and the helpful suggestions of its staff of specialists are available to all who are interested in industrial development, public improvements, and conservation of resources.

The new Natural Resources Law defines a specific program in considerably more detail than any previous act. It says:

SEC. 802. * * * The division of geological survey, department of natural resources, shall:

a. Collect, study and interpret all available information pertaining to the geomorphology, stratigraphy, paleontology, mineralogy, and geologic structure of the state and shall publish reports on the same.

b. Collect, study and interpret all available data pertaining to the origin, distribution, extent, use and valuation of mineralogical and geological raw materials and natural resources such as: clays, coals, building stones, gypsum, limestones and shales for cement and other uses, petroleum gas, brines, saline deposits, molding sands, and other natural substances of use and value, excluding only those pertaining to water usable as such for agricultural, industrial, commercial and domestic purposes, but not excluding other rock fluids such as natural and artificial brines and oil-well fluids.

c. Make special studies and reports of resources of geological nature within the state which in its discretion are of current or potential economic or educational significance. The division of geological survey at its discretion shall examine the technological processes by which mining, quarrying, or other extracting processes may be improved, or by which materials now uneconomical to exploit may be extracted and used commercially for the public welfare.

d. Make, store, and have available for distribution maps, diagrams, profiles and geologic sections portraying the geological characteristics and topography of the state, both of general nature and of specific localities.

e. At its discretion or at the request of other agencies of the state government, advise and consult with representatives of those agencies on problems of geological nature.

There are some other minor provisions and the section on geology closes by stating:

SEC. 802-3. Nothing in this act shall be construed as limiting the authority of the chief of the division of geological survey to investigate, survey, interpret and report matters relating to the geological or mineralogical conditions of the state, or to technologies pertaining to them, to the end that industry, commerce, education, public health and recreation may be advanced.

There are features of other acts which do limit the activity of the Survey however, particularly the lack of certain provisions in the biennial appropriation acts.

Over 30 separate projects are being carried forward at the present time. Surface geology studies are progressing in Adams, Athens, Coshocton, Gallia, Hocking, Lucas, Monroe, Morgan, Perry, Stark, Tuscarawas and Washington counties. Such projects include studies in stratigraphy, paleonotology, geomorphology, structure and particularly the economic geology of the area.

Editorial work is progressing on a voluminous manuscript by Dr. Wilbur Stout on the Monongahela formation of Ohio and one on the Mississippian formation by Dr. J. E. Hyde.

The coal section of the survey is engaged in a continuing, long range program of accumulation and correlation of data on the geology, thickness, composition, and reserves of Ohio coal desposits.

In co-operation with the Engineering Experiment Station of the Ohio State University, a study is being made of the uses of Ohio coals as a source of synthetic liquid fuel. Another co-operative project with the Station is a detailed field sampling and laboratory analytical study of the Meigs Creek or No. 9 coal. Vast reserves of this coal exist in Ohio but certain types of treatment or beneficiation may greatly improve its quality.

The oil and gas section is also engaged in a long range program of collection detailed information on the more than 200,000 wells which have been drilled in Ohio.

The section prepares each year a review of oil and gas drilling activity in the State.

A thorough study of oil and gas in Perry County is being made and a chapter on the subject will be incorporated in the county bulletin.

Industrial minerals are the mineral resources other than the metallics and the mineral fuels. Clay, salt, limestone, and dolomite, sand and gravel, gypsum, and sandstone are important Ohio industrial minerals.

Progress is being made on the study of the Sharon Conglomerate, a source of silica used by a number of Ohio industries.

Detailed studies of the joints in the limestones of Western Ohio is being carried forward and may have a number of future economic applications.

Chemical analyses of over 130 limestone samples from Eastern Ohio have been completed and a bulletin on the subject is in preparation.

A reconnaissance study of the sand and gravel despoits of the northern half of Ohio has been made and a report issued. Much additional work is needed on these resources.

A co-operative study with the Cleveland Illuminating Co. on salt and brines of Northern Ohio is being carried on.

Work on a new Geography of Ohio is going forward with publication expected in early 1952.

A limited amount of work is being done on the geology of Lake Erie and it is hoped that additional studies can be carried on during the coming year.

Collection of cores and of oil and gas well cuttings is continuing and studies of these sub-surface materials is under way.

Approximately one-third of the time of the entire staff is devoted to public service. This includes the answering of inquiries by telephone, telegram, letter, and personal interview; the preparation of news releases, technical papers and pamphlets of general interest; service on various boards and committees; and the presentation of talks and reports before numerous organizations.

So much for the present program of the Survey. Of course we have some problems too. Through the years the major problem has always been an adequate

appropriation to meet the responsibility imposed by law. In 1838 Mather closed his report on the following optimistic note:

"Ohio has never yet retraced her steps in any work of public utility that she has undertaken, and the idea can scarcely be entertained, that she will withhold the appropriation of a few thousands, by the expenditure of which millions will be returned to her citizens."

Appealing to the far-sightedness of our people has not always had the desired result, however. At one time in the depth of the depression the entire appropriation was discontinued and Dr. Stout carried on for some months without any funds whatsoever.

Today our appropriation is not adequate to meet the responsibility of the new law. Nor is it adequate to serve our people in the way that the citizens of many other states are being served geologically. Illinois is investing ten times as much each year and 19 other states carry on more extensive programs than does Ohio. This in spite of the fact that though 35th in size we rank 9th in value of raw minerals produced. This is our major problem.

Another problem, regardless of appropriations is the matter of space and location. For over half a century the Survey has been located in Orton Hall, the geology building on the Ohio State University campus. This building, constructed in 1893 houses, in addition to the University's Geology Department, the Geological Museum and the Orton Memorial Library of Geology.

If the State constructs a Natural Resources building will it provide the proper atmosphere for continued basic research, an atmosphere which certainly exists on a great University campus? If the Survey remains in Orton will its growth be stunted by the lack of Laboratory facilities so essential to implementation of its assignments under the new law? This too is a perplexing problem facing your Survey.

Personnel is not a pressing problem at the moment. Ohio has always had her share of outstanding scientists, including geologists. Over 50 applications for summer work or full time employment have been received in recent months. The state is in the process of establishing a modern civil service classification system and apparently geologists will be properly recognized. The personnel problem is merely the appropriation problem in disguise.

The Division of Geological Survey, like its predecessor, the Geological Survey of Ohio, operates on a broad policy of careful and efficient expenditure of the taxpayers' money. Co-operation is the answer to a limited budget. If Federal, State or industrial organizations are satisfactorily performing functions assigned to the Survey I see no need for duplication. Our relationships with the Engineering Experiment Station of the Ohio State University, the Geology Department, the Division of Mines, the Division of Water, the Highway Department, the Industrial Relations Department, the Commerce Department, the various mineral associations, the U. S. Geological Survey and Bureau of Mines, the Ohio Chamber of Commerce and other like organizations are excellent. Co-operative projects are carried on with many of these groups. We could not do our job without their support.

This is a conservation program. The key to mineral conservation is a policy of intelligent use. True conservation is making the most of what we have. Such a policy is founded on the following principles:

1. Avoid waste and needless destruction of our mineral resources.
2. Gain full basic knowledge of our resources and their potentialities.
3. Exploit low-grade reserves and find new resources through improved exploration and production methods.
4. Increase recovery of minerals in processing through improved methods.
5. Find uses for abundant latent mineral resources and widen the utilization of byproduct minerals.

6. Adopt broad, forward-looking research programs to advance all phases of mineral technology.
7. Promote a healthy mineral economy which will encourage the investment of risk capital vital to mineral production and which will insure the maximum life span to declining production.

We are dedicated to such a program by tradition, by past performance and by the new natural resources law. You may rest assured that in the future, as it has in the past, your Survey will be making its contribution, through science, to a greater Ohio.

OHIO ACADEMY OF SCIENCE NEWS

The members of the Academy will be interested to know of the results of the effort to increase the membership. At the Council meeting on April 27, 261 members were added to the organization, an all-time high for any single year and the total membership is at an all-time high of almost 1200 members. This makes our Academy one of the largest state Academies and it is much larger than many of the national organizations to which most of us belong. The membership by sections is as follows:

A. Zoology	260
B. Plant Sciences	197
C. Geology	164
D. Medical Sciences	166
E. Psychology	55
F. Physics and Astronomy	50
G. Geography	49
H. Chemistry	109
I. Mathematics	27
J. Science Education	60
K. Anthropology and Sociology	36
Libraries, Corporations and Institutions	20
Total	1,193

Amendments to the constitution provided for two new classes of membership, Corporation and Institution. A special committee has been at work securing such memberships and to date four Corporation and twelve Institution Memberships are in force. Many of the members could assist in this project by a little missionary work in the organization, corporation or college and University, with which you are connected, but you are asked to work closely with the special committee so that efforts will not be duplicated and so that no organization will feel it is being "high pressured" into taking out a membership. Dr. H. H. M. Bowman, of the University of Toledo, is chairman of the committee. Please contact him to offer your assistance.

The present institution members are Baldwin-Wallace College, Bowling Green State University, Case Institute of Technology, Fenn College, Mary Manse College, Marietta College, Miami University, Ohio State University, Ohio University, Ohio Wesleyan University, University of Cincinnati and Wittenberg College.

The Treasurer is making a special effort to collect all dues which are outstanding. If you have not paid for 1950 please remit at once so you will not miss issues of the JOURNAL and so your name will not have to be removed from the membership roll. Remember that the dues are now $3.00 per year as a result of an amendment passed at the annual meeting.

PROGRAM, RESPONSIBILITIES, AND PROBLEMS CONCERNING WATER RESOURCES IN OHIO

R. J. BERNHAGEN,
Principal Geologist, Ohio Division of Water

Recently there has been much publicity regarding water shortage in a number of areas throughout the nation.

Most prominent of these of course is the New York situation. Other industrial areas such as Louisville, Memphis, Houston and Youngstown are faced with the same problem.

These are disheartening affairs in a nation such as ours in which technical "know how" seems unlimited. Our engineering and scientific achievements are excelled by no other country in the world, yet we seem to be unable to accomplish a solution to the problems of our water resources.

These recent water shortages, tragic in a way, have been beneficial in one respect to the nation as a whole. The publicity has been helpful in awakening the nation to reconsider the status of one of its most valuable natural resources. At no time in the history of our country have the people been so conscious of water and the problems related to it. Agencies of the Federal government have been studying the problem for many years and most state governments have in recent years instituted programs of study to determine causes and to recommend remedial measures.

In the State of Ohio an active program to study Ohio's water resources has been in effect since 1941 when the Ohio Water Supply Board was created by the General Assembly. Later the organization became the Ohio Water Resources Board and today the work is carried on by the Division of Water in the Department of Natural Resources.

PROGRAM OF OHIO DIVISION OF WATER

Briefly, the duties of the Ohio Division of Water entail the collection, study and interpretation of the available data related to the water resources of the State of Ohio. In the formulation of the law creating this organization it was the intent of the legislators to create an agency that would collect the basic data regarding the status of our water resources, analyze the data and make it available to the citizens of the State so that ultimately a sound water conservation program could be established.

However, before discussing a water conservation program, it is necessary to define what is meant by "water conservation." Unlike other minerals, water as it occurs in Ohio is replenished annually and cannot be saved or conserved by non-use. Conservation of water means obtaining the maximum beneficial use of water and protecting those resources from polluting or deleterious matter which render water unfit for use. It is that concept on which the program of the Ohio Division of Water is based.

The program of the Division divides itself into the following categories:

1) Water resources inventory.
2) Field investigations.
3) Analysis of inventory and field data.
4) Publications and reports of inventory and analysis.
5) Regulation.
6) Assistance to individuals, industries and public agencies.

First on the list is water resources inventory. Mr. C. V. Youngquist,[1] Chief of the Division of Water, has stated "a fundamental conservation measure is a

TABLE I

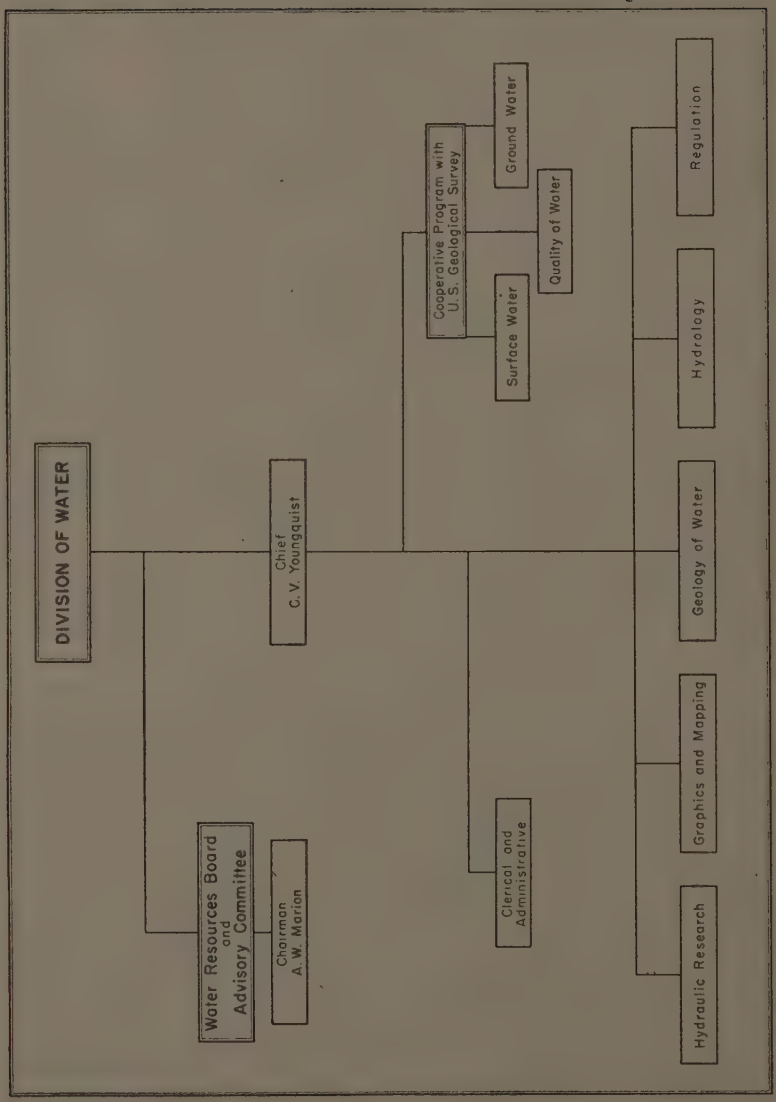
ACTIVITIES OF THE OHIO DIVISION OF WATER

INVENTORY	INTERPRETATION	REGULATION	CONSTRUCTION
A. Stream Flow 1) Gaging 2) Chemical quality 3) Siltation a) Suspended b) Deposits in reservoirs 4) Pollution	A. Statistical Analysis 1) Flood frequency 2) Drought frequency B. Flow Characteristics 1) Flood flow 2) Low flow 3) Relation to soil, geology and land use C. Storage Requirements D. Design of Bridges and Culverts E. Chemical Quality 1) Treatment required 2) Deleterious factors 3) Pollutants	None Common Law of Riparian Rights	A. Building of Dams Financed by Issuance of Revenue Bonds B. Bridge Dam Law C. Farm Ponds
B. Ground Water 1) Gaging (Water table fluctuations) 2) Survey of pumpage 3) Pumping tests 4) Chemical quality 5) Geology of water 6) Processing of well logs	A. Quantities Available (yield) B. Source and Rates of Recharge C. Pump Sizes and Rates of Pumping D. Well Spacing E. Chemical Quality 1) Treatment required 2) Deleterious factors 3) Pollutants F. Extent and Thickness of Aquifers	A. Filling of Well Logs by Drillers B. Rules and Regulations to Prevent Contamination of Ground Water C. Enforcement	None
C. Climatic Factors 1) Rainfall 2) Temperature 3) Evaporation 4) Assemble in available form	A. Rainfall Analysis 1) Frequency and magnitude of intense rains 2) Frequency and duration of drought 3) Trends B. Temperature Analysis 1) Distribution 2) Trends C. Evaporation		

continuing inventory of the supply of water available from streams and underground reservoirs and the chemical and physical properties of those supplies. This

[1]C. V. Youngquist, Annual Report of the Division of Water and Ohio Water Resources Board for the year 1949.

TABLE II


DIVISION OF WATER
Water Resources Board and Advisory Committee
Chairman A. W. Marion
Chief C. V. Youngquist
Clerical and Administrative
Cooperative Program with U.S. Geological Survey
Surface Water
Ground Water
Quality of Water
Hydraulic Research
Graphics and Mapping
Geology of Water
Hydrology
Regulation

inventory is and must be carried on continually to prevent over-development or misuse of Ohio's most valuable resource." The water inventory requires measurement of water in all phases of its occurrence. Principal determinations are precipitation, stream flow, ground-water fluctuations, evaporation and transpiration, soil moisture, and the chemical and physical quality of water.

At the present time quantity of stream flow is measured at 188 gaging stations strategically located throughout the State. Automatic recording gages are maintained on 111 observation wells which are drilled into a majority of the principal water bearing formations. These records give a positive answer to such questions as "Is the water table falling?" During 1949, 262 chemical analyses were made of water from the streams and underground reservoirs. A survey of ground water pumpage of the State indicates that over 500 million gallons are pumped from the ground each day. A pumpage inventory will be conducted periodically to determine areas in which over development is occurring. Approximately 30 pumping tests have been conducted at municipal and industrial well fields. Such tests reveal the hydraulic properties of aquifers and are fundamental in the establishment of pumping rates and in the spacing of wells to obtain the most efficient well field development. The Division receives and processes approximately 9,000 water well logs each year.

The above group of activities is far from complete but it is presented to exemplify the type of work involved in a water resources inventory. Many phases of the inventory are conducted co-operatively with the Surface Water Branch, Ground Water Branch and Quality of Water Branch of the U. S. Geological Survey. For the sake of brevity the activities of the Division of Water are outlined on the chart in Table I and the organization chart is shown in Table II.

Factors Involved in Water Problems

In view of the fact that considerable publicity has been given to current water shortages, both in Ohio and the nation, there has arisen in the minds of many people certain false concepts regarding the status of our water supplies, both present and future. It may be advisable at this time to discuss the causes of water shortages and the possible remedial measures that may be taken, and from that discussion some of the problems of the Division of Water will become apparent.

The causes of water shortages automatically fall into two categories—assumed causes and real causes.

Assumed Causes

1) In the minds of many people it is believed that our climate is changing—that we are getting less and less rainfall every year. This is far from true. Examination of rainfall records from the U. S. Weather Bureau shows this is not the case.

2) A second assumption is that the water tables throughout the country are dropping. One popular writer has made the claim that ground-water levels in Ohio have dropped 50 feet in the last 25 years. In some areas in Ohio, water levels have been rising in the past few years. Ground-water levels are recorded every minute of the day by 111 automatic recording instruments installed on observation wells, and analysis of these records show that there is no continuous decline in ground-water levels. Only one area has experienced critical lowering of water levels. This area will be discussed later.

3) It is believed that water shortages have been brought about by the removal of the forests. Locally under favorable conditions it may have some influence but to say that the removal of our forests and the abuse of our farm lands has created water shortage universally has no basis in fact.

Real Causes

There are two principal causes of water shortages—droughts and over-development.

The source of all water is the atmosphere. Whether it is ground water or surface water, it originates from rainfall. It is rainfall that keeps our streams flowing and it is rainfall that recharges the underground reservoirs. In periods of deficient rainfall our surface water is diminished and our water tables are lowered. In the centuries past, this country, as well as other countries, has witnessed periods of drought as well as periods of plentiful rainfall. The magnitude, distribution and frequency are the factors which affect the amount of water available for human consumption. In the design of water supply systems these variable factors must be taken into consideration.

In the development and use of our water resources, we must recognize certain things.

1) That water resources are limited—there is no such thing as an unlimited water supply. This applies to both surface water and ground water. There is no great difference between a surface-water reservoir and a ground-water reservoir—you can see one but not the other. They both have definite physical limitations and they both behave according to certain established physical laws. Reservoirs will yield just so much water. In the case of a surface-water reservoir, the yield is determined by the design of the reservoir. In the case of a ground-water reservoir the yield is determined by the physical make-up of the aquifer and its hydraulic properties.

Most of the current shortages have arisen, not from natural causes, but because of overpumpage which has come about from the increased demands for water.

2) We must recognize that as our population increases the demands for water will increase. In the past ten years the consumption of water in this nation has about doubled. In another ten years that demand may again double.

Ground-water consumption in the nation is about 20 billion gallons daily. Here in Ohio daily pumpage from the ground is about 500 million gallons. With the expansion of industry, the growth of municipalities and the increase in demand for water for irrigation the above figures will continue to mount.

A majority of the water shortage problems involve ground water, and therefore this discussion shall be confined to ground water. Furthermore a consideration is given to the problem as it affects the State of Ohio rather than the nation.

The following table lists those areas in Ohio where ground-water pumpage exceeds 10 million gallons per day.

INDUSTRIAL AND MUNICIPAL GROUND-WATER PUMPAGE

	Million gallons per day
Montgomery County	93.0
Stark County	66.0
Butler County	50.0
Hamilton County	45.0
Franklin County	30.0
Summit County	28.0
Ross County	27.0
Muskingum County	17.0
Richland County	13.0
Jefferson County	12.0

Of all the heavily pumped areas in Ohio only one is experiencing a critical shortage of water. This is the Mill Creek Valley area of Hamilton County. The ground-water requirements of the industries and municipalities in the Mill Creek Valley have exceeded for years the amount of water available in the underground reservoir. The daily pumpage has averaged about 14 million gallons since 1939. The average rate of recharge over a long period is estimated to be 11 million gallons per day. As a result ground-water levels have been lowered as much as 90 feet below the surface and will continue to decline so long as the pumpage is in excess of the natural recharge of the aquifer. The hydrograph of observation well No. 265–5 in this area is shown on Fig. 1 and a north-south longitudinal profile of

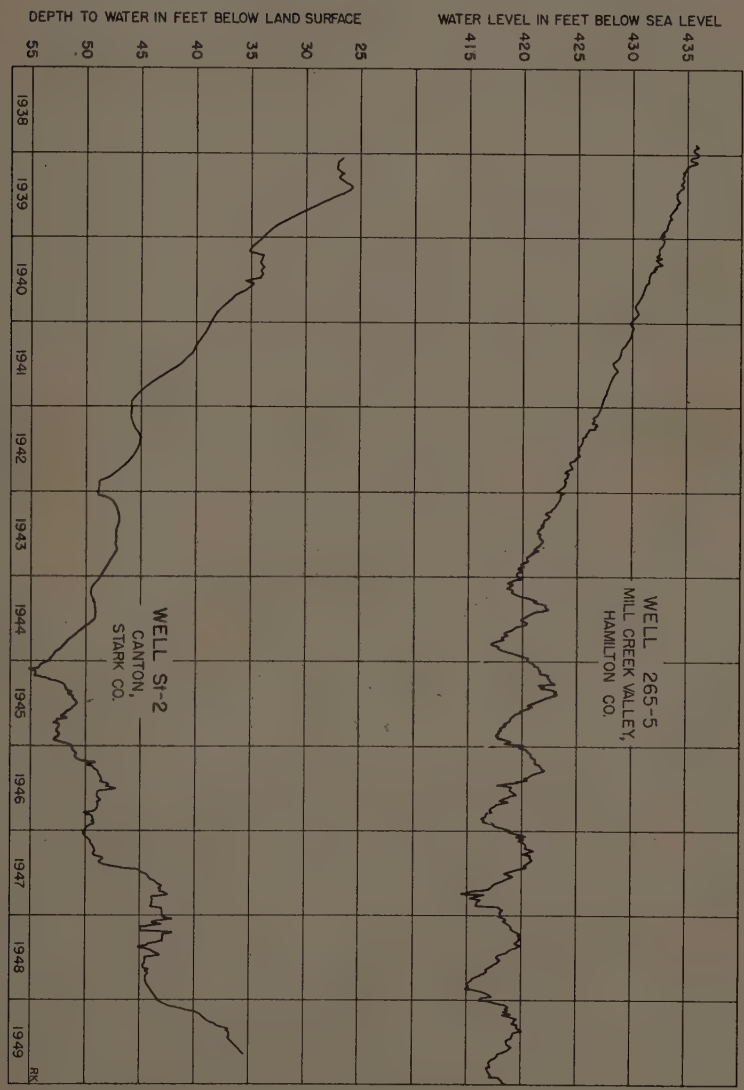


Fig. 1. Hydrographs of observation wells.

the piezometric surface is shown in Fig. 2. Organized efforts of the industries in the valley have resulted in decreasing the pumpage and to some extent slowing down the rate of decline. Conservation methods have been adopted and investigations are in progress to determine the feasibility of importing water from other ground-water areas within the county. Previous to 1945 in the Canton area of Stark County serious declines in ground-water levels were occurring. This is shown by the hydrograph of well ST-2 on Fig. 1. Following the cessation of World War II water demands by war industries decreased and since that time the City of Canton has developed a new well field removed from the area of heavy pumpage. As a result of the redistribution of pumpage, water levels have raised to a point higher than existed in 1940.

Throughout Ohio there are a number of villages and small cities which are experiencing difficulty in keeping up with the increased demands of a growing community. In some instances the geology of the area is such that additional large volumes of ground water are not available and it is advisable in such cases to change the source of supply from ground water to surface water. In other instances it is possible to spread the pumpage over wider areas. A common failing of many municipal well fields is the close spacing of wells; often 3 or 4 wells will be placed on an acre of land. Furthermore it must be borne in mind that there are extensive areas in Ohio where subsurface conditions do not allow for the accumulation of large volumes of ground water. In these areas attempts to develop municipal or industrial supplies should be discouraged and farm and domestic consumers should be informed as to the best type of water supply development to suit the prevailing condition.

Regarding the solution of existing ground-water supplies certain procedures are self-evident.

1) Redistribution of pumpage in some areas.

2) Development of supplementary supplies from other sources.

3) Use of surface water in winter and ground water in summer where temperature is an important factor.

4) Artificial recharge—either by water spreading or by recharge wells. This assumes additional water is available.

5) In certain rural areas where the subsurface material is relatively impermeable additional low yielding wells are advisable and supplemented by farm ponds and cisterns.

It must be borne in mind that ground-water problems are localized and that solutions must be based on careful studies of the local geologic and hydrologic conditions. The application of certain remedial measures may work in one area but fail in another. This may be exemplified by contrasting the situations existing at Dayton and Greenville. At Dayton the aquifer is recharged by the water spreading method. It is effective because the gravel aquifer exists at the surface and continues downward to a considerable depth. At Greenville about 40 feet of clay overlies a gravel aquifer. Water spreading in this area would be ineffective.

Thus far no mention has been made of reforestation as a means of solving water problems. This feature has not been mentioned because of its questionable value. It is important to recognize the effectiveness of forest cover in retarding runoff, reducing soil erosion and increasing soil moisture but as a universal panacea to the solution of water supply problems reforestation cannot be considered as a prime factor but only as a supplement to the overall local picture. Only under ideal conditions of geology and topography will forest cover be beneficial in recharging ground water. Recharge, either by natural processes or man-made devices, presupposes one condition, that a porous and permeable medium is present to conduct the water from the surface to the ground water reservoir. Diller has shown that in level country the effect of forests in flood control and underground storage is of

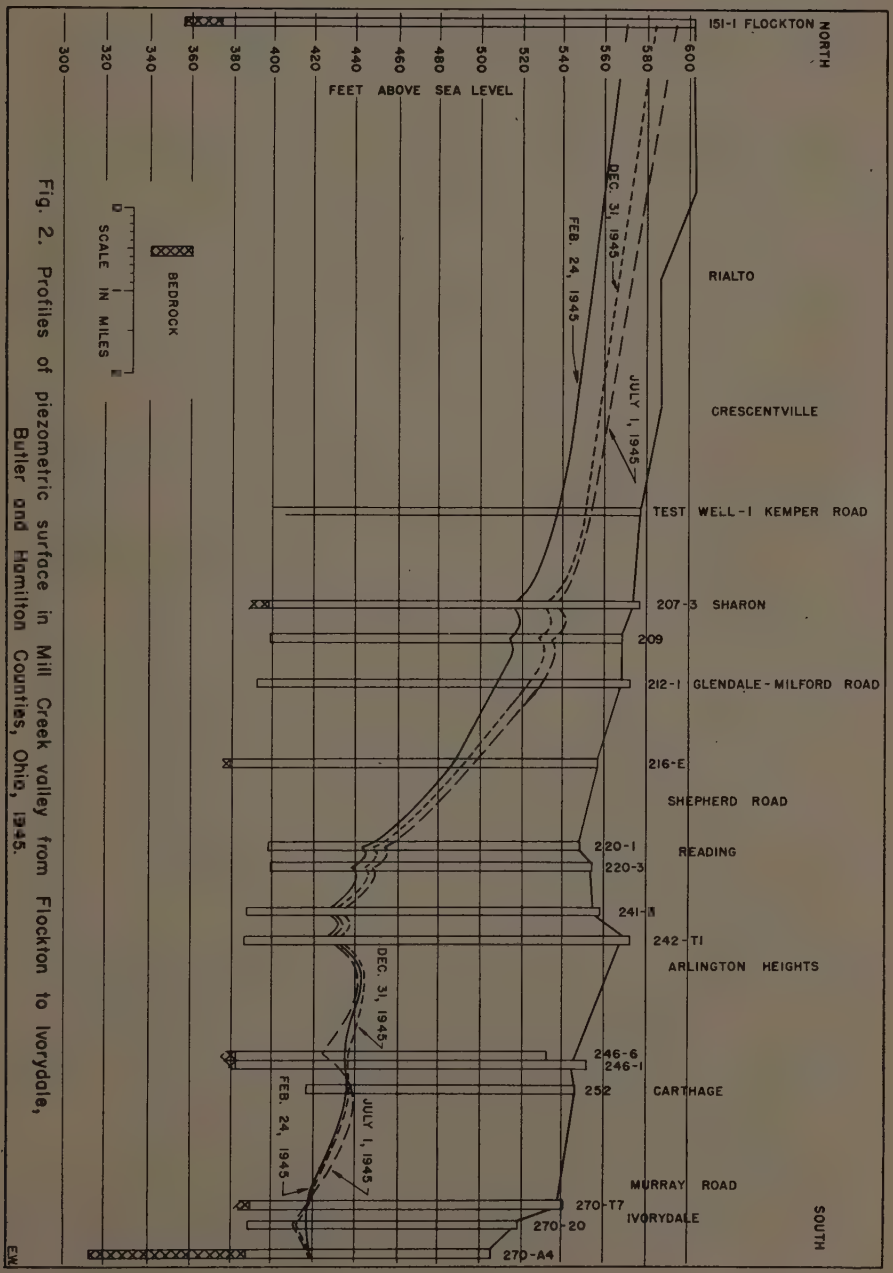


Fig. 2. Profiles of piezometric surface in Mill Creek valley from Flockton to Ivorydale, Butler and Hamilton Counties, Ohio, 1945.

little consequence. In fact, it has beeen demonstrated that in level country forests tend to lower the water table and reduce soil moisture to a greater degree than other forms of vegetation. Diller[2] clearly expresses the attitude of foresters on this subject in the following quotation:

"It is apparent that the water shortages in many parts of Ohio during recent years cannot be attributed solely to the lack of forest cover. Very few foresters claim that forests will maintain a high water level when prolonged dry periods occur and where there is heavy pumpage for industrial uses. Furthermore, most foresters concede that floods which are produced by exceptional meteorological conditions cannot be prevented by forests. But without the mitigating influence of forests, floods are more frequent, more severe and more destructive. It is important that we recognize the beneficial effects which forests have on water relations but that we must refrain from exaggeration. Well managed forests can justify themselves through wood production and erosion control without the necessity of making broad claims about their effect on water tables and floods."

In conclusion it may be said that there is no present danger of depleting the ground-water supplies in Ohio except locally. Water shortages are not a recent development. Temporary and localized shortages have existed since our country was settled. But in the early days there was some excuse for failures. Knowledge of geology, hydrology and hydraulics was in its infancy and errors in judgment were common. In the not too distant past lack of knowledge or poor judgment has resulted in some of the shortages which exist today.

In order to accomplish a sound program of water conservation in the State of Ohio certain long term objectives are imperative. The following objectives have been set forth by Mr. C. V. Youngquist[3], Chief, Ohio Division of Water in his report to the Governor and the General Assembly of the State of Ohio.

LONG TERM OBJECTIVES

1) Action programs on the wise utilization of water must be based on adequate facts on quantity and quality of available water. These facts must be collected now for the expanding use and development of water in Ohio which is certain to occur.

2) Most water problems are unique to an area, and each requires an individual plan. No ready made plan can be applied to a region.

3) Any successful plan for wiser water use will require a combination of methods of engineering, hydrology, geology, soil conservation, and reforestation.

4) Any water resources development should be integrated with an overall basin plan with proper consideration of regional and functional needs in order to insure the best overall use.

5) The river basins of the state should be examined, investigated, and classified as to potential use with sufficient flexibility to permit alterations as conditions require. Such plans will require records of stream regimen, ground-water fluctuations, quality of water determinations, and other basic data.

6) Underground water must be preserved against over development and reckless drilling operations. Experience indicates that additional regulatory authority may be required to obtain the desired results.

---

[2]Oliver D. Diller, "Forests and Water," OSU Engr. Exp. Sta. News, April, 1946.

[3]C. V. Youngquist, Annual Report of the Division of Water for the year 1949.

CONCERNING RATES OF UTILIZATION OF SOME OF THE FOREST RESOURCES, AND THEIR ECONOMIC IMPORTANCE, IN CANADA[1]

FRED H. GLENNY[2]

The economic life of a new or pioneer country is at first entirely dependent upon the raw natural resources of the country. Later on as the original supply dwindles, is depleted or exhausted, the people turn to manufacturing, farming, fishing, shipping, and similar pursuits which do not require further gross depletion of the available resources, but rely more upon efficient and more nearly complete utilization of these raw resources.

Canada is a fairly young country by most standards, but it is a land of such great area and such low population that the development of an independent and natural internal economy has resulted in the expenditure of a vast amount of her best resources, both timber and mineral, in an effort to become more self-sufficient.

Fur, fish, and forests have served as the basic commodities for trade for the past 200 or more years. Serious exploitation of the timber resources has taken place during the past 100 years, with the resulting depletion of available first grade timber.

During the past 40 to 50 years, however, there has been a strong effort made to establish a workable program to conserve the chief natural resources, and to replenish these wherever possible.

In some areas which were studied recently, a program of reforestation and improvement in land use has been suggested and first steps appear to have been taken to initiate an effective cutting and forest management program. For the most part, however, the large lumber and pulpwood operators and associated industries have "managed" the areas which they hold under lease or otherwise control. In scattered areas, however, where the cutting is under individual lease or contract, little effort is made to do any selective cutting, with the result that any tree of six inches diameter may be cut and used for pulpwood or stovewood. This is particularly true of cut-over areas of western Quebec.

Some statistics may serve to point out the value of the wood and timber resources of Canada, and show some of the value of both the primary and secondary forest products to the United States.

LAND AND WATER AREAS:			
Area of Canada (exclusive of Labrador and Newfoundland):			
Land Area	3,462,103	square miles	
Water Area	228,307	" "	
Total Area	3,690,410	" "	
Area of Labrador	110,000	" "	(approximate)
Area of Newfoundland	42,734	" "	"
Total Area at present	3,843,144	" "	
Area of United States and Dependencies	3,738,395	" "	
Area of United States	3,022,387	" "	
Area of Alaska	586,400	" "	
Area of Europe	3,776,700	" "	
POPULATION:			
Canada			11,506,655
Labrador			4,716
Newfoundland			313,000
Total			11,824,371
United States (1940)			131,669,275
Alaska (1940)			72,524
United States 1950 estimate—between 149 and 150 millions.			

[1]Based on a paper, "Rape of the Bush," presented before the Ohio Academy of Science, Capital University, April 28, 1950.

[2]Visiting Lecturer in Biology, The College of Wooster, 1949–1950.

Distribution of Canadian population:	
Urban centers	5,572,058
Rural Districts	4,804,728
Other	1,129,869 (approximate)

Agriculture ranks first in primary and secondary industries in Canada with a value in 1947 of $1,579,604,000. The agricultural lands in 9 provinces totals approximately 1,276,109,440 acres. The potential agricultural land is estimated at 352,157,190 acres. About 60 million acres are in field crops, while 8,250,000 acres are in pasture.

Forestry and forest products rank second in Canadian industries with a value in 1947 of $953,918,800. Since then, however, there has been further increases in utilization and, as a result, increases in the value of the primary and secondary products. By 1950, 37% of the land area of Canada, and 58% of the land area of the nine provinces are occupied by forests.

	1945	*1949*
Productive Forest	38.3%	32.7%
Softwood	23.3%	17.7%
Mixedwood	10.5%	10.5%
Hardwood	4.5%	4.5%
Non-productive Forest	20.0%	24.8%
Non-forested Land	41.7%	42.5%

	1947	*1949*
Productive Forested Lands	813,110 square miles	701,232 square miles
Non-productive Forested Lands	477,850 " "	573,608 " "
Non-forested Lands	2,171,143 " "	2,187,263 " "
Total Land Area of Canada	3,462,103 " "	

Net value of production of the primary and secondary industries of Canada, for 1947	$7,765,415,275
Agriculture	1,579,604,000
Forestry	953,918,800
Mining	552,309,949
Electrical Power	233,860,860
Fisheries	110,088,471
Trapping	16,842,966

Employment in the logging industry, as of 1 December, 1949, for establishments of 15 or more men, reveals that for Canada 73,952 men were employed. Of this total, 17,992 were employed in Ontario, while 33,751 worked at logging in Quebec. Thus, more than two-thirds of the numbers employed in logging worked in two provinces alone.

Based on information available prior to 1948, 58.3% of the provincial lands were forested. Of this, 20% was non-productive forested land and 38.3% produced the wood and timber for the trade. Of the total land area of Canada, including the Northwest Territories and Yukon, but excluding both Labrador and Newfoundland, only 37.3% of the land area is forested, and 23.5% is productive forest land, while 13.8% is in non-productive forests. Exclusive of Labrador and Newfoundland, Canada has 62.7% of the land area unforested, while only 41.7% of the provincial land area is non-forested.

Total Merchantable Forest Types:	*1945*	*1949*
CANADA	392,085 square miles	294,180 square miles
Percentage of Land Area	11.3%	8.5%
9 PROVINCES	384,085 " "	286,180 " "
Percentage of Land Area	19.2%	14.3%
Quebec	229,840 " "	131,985 " "
Ontario	66,900 " "	66,900 " "
British Columbia	35,400 " "	35,400 " "

Total Young Growth:	*1945*	*1949*
CANADA	421,025 square miles	407,052 square miles
Percentage of Land Area	12.2%	11.7%
9 PROVINCES	382,025 " "	368,052 " "
Percentage of Land Area	19.1%	18.4%
Quebec	72,860 " "	58,680 " "
Ontario	106,900 " "	106,900 " "
British Columbia	50,490 " "	50,492 " "
Non-productive Forested Land:-		
CANADA	477,850 square miles	573,608 square miles
Percentage of Land Area	13.8%	16.6%
9 PROVINCES	401,850 " "	497,608 " "
Percentage of Land Area	20.0%	24.8%
Quebec	69,590 " "	165,394 " "
Ontario	63,400 " "	63,400 " "
British Columbia	128,500 " "	128,564 " "
Non-forested Land:		
CANADA	2,171,143 square miles	2,187,263 square miles
Percentage of Land Area	62.7%	63.2%
9 PROVINCES	835,359 " "	851,479 " "
Percentage of Land Area	41.7%	42.5%
Quebec	151,570 " "	167,801 " "
Ontario	126,082 " "	126,082 " "
British Columbia	144,829 " "	144,823 " "

In 1947, primary forest production rose to a value of $519,804,128, representing the utilization of 3,091,086 units (1000 cubic feet) of merchantable timber. Of this amount, Quebec produced 1,114,018 units, British Columbia yielded 666,142 units, and Ontario produced 613,919 units. During the same period, a total of 5,877,901 units (1000 feet board measure) of lumber were produced in Canada, with a value of $322,048,356. Of this, British Columbia produced 2,707,052 units with a value of $164,199,747; Quebec ranked second with a total of 1,227,055 units and a value of $63,258,288; and Ontario stood third in production with some 733,129 units having a value of $41,526,059. Ontario produced 2,130,838 rough cords of fuelwood, with a value of $13,473,594, while Quebec produced 3,897,013 rough cords, with a value of $17,678,762.

Of accessible productive forested land, Ontario has 52,500 square miles in merchantable timber and 95,100 square miles in young growth—a total of 147,600 square miles, while Quebec has 95,087 square miles of merchantable timber and 50,305 square miles of young growth, with a total area of 145,392 square miles of timber lands.

In 1948, wood pulp production for Canada reached a level of 7,675,079 tons, with a value of $485,966,164. At the same time, paper production was in the vicinity of 6,063,646 tons, with a value of $582,346,842. For the same period, the apparent production of pulpwood in rough cords for Ontario was 3,390,284 units, an increase of 257,666 rough cords over the 1947 level of production; while Quebec produced 6,321,800 units, an increase of 374,837 rough cords over the 1947 level. The attending value of production of pulpwood for 1948: Ontario—$76,830,250, an increase of $14,648,708 over 1947; Quebec—$148,384,145, an increase of $19,645,567 over 1947. Exports of primary forest products, in 1948, amounted to $66,186,095, an increase of more than $10,000,000 over the 1947 level.

CANADIAN LUMBER EXPORTS
(Units of 1000 feet board measure)

	1947	*1948*
All countries	2,735,027	2,467,740
United Kingdom	1,121,244	565,653
United States	1,065,216	1,625,223

There was a decrease in the total exports, in one year, of 267,287 units. The United Kingdom reduced imports from Canada by 555,591 units, while the United States increased imports from Canada by 550,007 units.

In 1948, total woodpulp exports amounted to 1,797,998 tons, with a value of $211,564,384. This represents an increased production of 99,286 tons over the 1947 level, and an increased value of $33,761,772. Of this, 170,596 tons were exported to Great Britain, an increase of 33,620 tons over 1947 exports; and 1,590,674 tons were exported to the United States, an increase of 91,373 tons over the 1947 business level.

Exports of paper in 1948 had a total value of $416,681,607, representing an increase of $43,611,269 over the previous year. Of this, 4,328,083 tons of newsprint had a value of $383,122,743. This represents an increased production-export of 107,304 tons in one year, with an increase of $40,829,585 for the same period. Of the total exports of paper, for 1948, the United Kingdom used 101,050 tons at $10,603,445, of which 60,690 tons were newsprint costing $5,319,660; the United States imported 4,067,709 tons of paper at a cost of $354,176,645, and 3,917,366 tons of this paper, with a value of $340,334,045, was in the form of newsprint.

These few facts and figures may serve to give an idea of the value of the forest products of Canada, and to a somewhat less extent, the importance and value of wood-products which are imported by the United States from our closest neighbor, Canada.

During the past few years there has been a phenomenal increase in the utilization of Canadian forest products. Comparisons can be made on utilization during 10 years of depression (1930–1939), six years of war (1940–1945), and two to three years of post-war prosperity. In the following tables, only averages (for a one year period) are used.

PRIMARY FOREST PRODUCTION

(Logs and Bolts, Pulpwood, Fuelwood, etc.)

1930–1939	$174,806,145
1940–1945	257,768,977
1946–1947	466,536,721

PRIMARY FOREST PRODUCTION

(In 1000's of cubic feet of Merchantable Timber)

Period	*Canada*	*Ontario*	*Quebec*
1930–1939	2,011,323	440,631	685,846
1940–1945	2,586,527	496,430	946,174
1946–1947	2,951,902	589,210	1,092,159

LUMBER PRODUCTION

(In 1000's of feet Board Measure)

Period	*Canada*	*Ontario*	*Quebec*
1930–1939	3,096,941	411,635	501,645
1940–1945	4,649,208	581,487	953,699
1946–1947	5,480,590	703,285	1,194,331

WOOD PULP PRODUCTION

(Total for Canada)

1930–1939	$ 87,520,735	3,739,583 Tons
1940–1945	192,337,261	5,460,475 "
1946–1948	392,381,208	7,181,389 "

PAPER PRODUCTION

(Total for Canada)

1930–1939	$141,880,985	3,160,054 Tons
1940–1945	244,999,424	4,241,936 "
1946–1948	495,468,170	5,728,615 "

The annual value of Primary Forest Products for the post-war period is more than 250% greater than the average value for the ten-year period of the depression. While the production of woodpulp is just less than double the depression production level, the value for the output has more than doubled per unit product.

From the above information, it might well be assumed that, at the present rate of forest products utilization, Canada may soon be faced with severe shortages in timber and pulpwood resources. While this would be true, in the absence of proper management practices, it is safe to say that many of the leaders in Canada are alert to the importance of the problem, and are taking some steps to avert excessive and gross depletion of this basic material which plays so important a part in the general Canadian economy. In the event of another war, at an early date, further depletion of the forested areas will undoubtedly occur. What ultimate effect this would have on the productivity of the forested areas cannot be adequately assayed at the present time. Needless to say, with the present rapid growth and expansion in the population and in industry in the United States, it is necessary to look to Canada to obtain many of the materials and products which are considered essential to our own way of life.

Inexcusable waste of natural resources has followed with man's exploitation of new lands, but continued wastage ultimately results in serious want. One of the largest causes of losses in forest resources results from fire. The annual forest fire losses in Canada, for the period 1939–1948 are reported to be as follows:

Merchantable Timber	439,389 acres
Young Growth	402,433 acres

Fires by Causes	Number	Percent
Smokers	1,049	19.8
Campfires	852	16.1
Settlers	658	12.5
Railways	501	9.5
Incendiary	187	3.5
Other man-made causes	684	12.9
Unknown	378	7.2
Lightning	979	18.5

The total estimated losses, including fire-fighting costs, each year amounts to $4,888,221.

ACKNOWLEDGMENTS

The writer wishes to express his gratitude to the Honourable H. L. Keenleyside, Deputy Minister of Resources and Development, Department of Mines and Resources, Ottawa, and to his assistants for the generous assistance given him in obtaining materials for this paper.

REFERENCE

Statistical Record of the Forests and Forest Industries of Canada, 3rd Edition. Ottawa, 1948. **Amendment List** (to the above)—1949.

OBSERVATIONS ON THE MICHIGAN FLORA, III[1]
THE FLORA OF GREEN ISLAND (MACKINAC COUNTY)[2]

EDWARD G. VOSS,
Mackinaw City, Michigan

Green Island is a heavily vegetated sand and gravel bar rising from the Straits of Mackinac about 400–500 yards from Pt. La Barbe, the nearest mainland (Mackinac County, Michigan). The island is approximately 600 meters long and varies from 30 to somewhat more than 80 meters in width. A curved arm to the northeastward forms a bay facing to the west. (See map, Fig. 1).

The island may be seen on the charts covering the Straits of Mackinac prepared by the Survey of the Northern and Northwestern Lakes and on the advance sheet for the south half, St. Ignace-Moran Quadrangle, State of Michigan, pub-

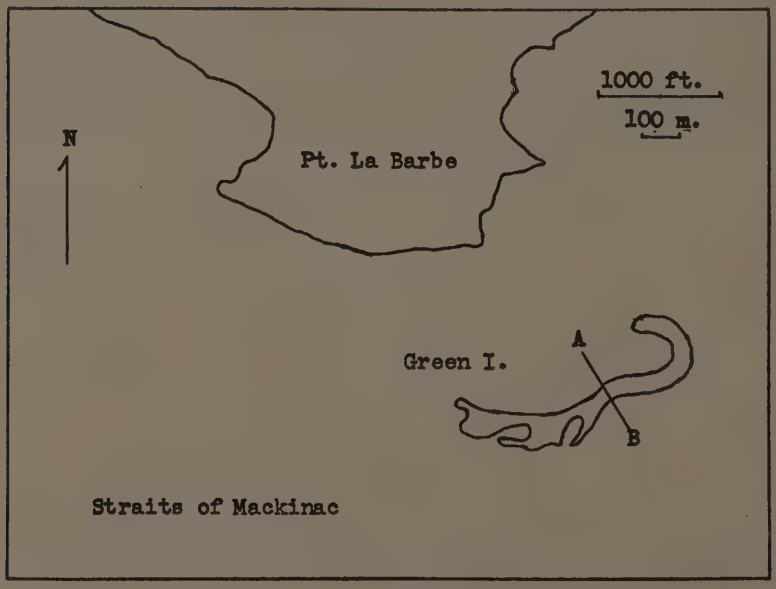


FIG. 1. Map showing Green Island and nearest mainland.

lished by the U. S. Geological Survey. The outline of the island on the latter map has been altered slightly in the preparation of Fig. 1. The "Official Map of Cheboygan County, Michigan" shows the island and names it, but gives no indication of its true shape. The detailed maps of Mackinac County distributed by the Michigan State Highway Department and the Conservation Department do not show Green Island.

The relative size of the island varies greatly as the level of the Straits of Mackinac goes up and down in the annual fluctuations of the Great Lakes. This

[1]Cf. "Literature Cited" for I and II.

[2]Contribution from the Biological Station of the University of Michigan. Presented at the Botany Section, Michigan Academy of Science, Arts, and Letters, at Ann Arbor, March 24, 1950.

situation accounts for the varied shapes given the island on the few maps which do show it. It is actually a higher part of a large crescent-shaped shoal off Pt. La Barbe. Especially in low water years, other small islands occur on this shoal, but none approach Green Island in size.

Collecting trips to Green Island were made on June 30, 1947, August 20, 1948, June 4, 1949, June 16, 1949, and August 4, 1949, so a fair seasonal picture was obtained. On August 4, 1949, some effort was made to note ecological groupings, and the profile appearing in Fig. 2 was prepared.

Gulls and terns use the island extensively as a nesting site; other birds are frequently seen on it, and a few song birds nest there. Some seeds may have been brought by birds, but the proximity to the mainland suggests wind and waves as the principal sources of plants. Local residents report deer swimming to the island, and fresh tracks were seen on August 4, 1949.

Human visitations are frequent, with the assorted purposes of bird photography, bird banding, hunting, fishing, and picnicking. Until several years ago local Indians visited the island regularly to obtain some plant, the identity of which is not known.

Algae, lichens, fleshy fungi, and mosses occur on the island, but this report and list deal only with the vascular flora.

There is not room on Green Island for proper development of many ecological associations, although as the profile in Fig. 2 shows, there is a clear zonation of

FIG. 2. Profile of Green Island, with vegetation zones indicated (see text for description). The southeast end of the profile is at the left; northwest, at the right. Horizontal and vertical scales are the same.

vegetation. Line A-B on the map (Fig. 1) crosses the island where the profile was made. The letters A-M on the profile indicate rather well-marked zones as follows:

A. Straits of Mackinac (rocky bottom).
B. Shore practically all rocks (about 1 dm. in diam.). Occasional plants are invading from the center of the island, with *Polygonum lapathifolium*, *P. ramosissimum*, and *Potentilla anserina* the most abundant. This and the next zone would be submerged in high water years.
C. Rocks with some sand. Vegetation predominantly composed of *Polygonum lapathifolium* and *P. ramosissimum*, with such plants as the following mixed in: *Artemisia caudata*, *Lycopus americanus*, *Potentilla anserina*, and *Verbascum thapsus*.
D. Practically bare sand with a few rocks; beach of average high water years. A few invading runners of *Potentilla anserina* are the only vegetation.
E. Sand, with pure growth of *Potentilla anserina*.
F. Much bare sand showing. Plants almost entirely *Asclepias syriaca* and *Elymus canadensis*.
G. Largely *Tanacetum huronense* growing in sand and somewhat shaded by *Cornus stolonifera*.
H. At the height of the island, a thicket of *Cornus stolonifera*, shading *Poa compressa*.
I. Sandy soil, with *Elymus canadensis*, *Poa compressa*, *Potentilla anserina*, and small *Cornus stolonifera* and *Populus balsamifera* most abundantly represented.
J. Another mixed zone, with a dense growth of *Elymus canadensis*, *Juncus balticus* var. *littoralis*, *Lycopus americanus*, *Potentilla anserina*, and *Solidago altissima*.

K. A very characteristic zone fringing the edge of normal wave action in high water years. *Aster junceus*, *Solidago altissima*, and *S. graminifolia* are the most conspicuous, with *Carex hystricina*, *Juncus balticus* var. *littoralis*, *Lobelia kalmii*, *Potentilla anserina*, and invaders from other zones.

L. Broad rocky shore, with a great variety of plants. Among those observed were *Brassica kaber* var. *pinnatifida*, *Carex viridula*, *Cornus stolonifera* seedlings, *Epilobium glandulosum* var. *adenocaulon*, *Eupatorium perfoliatum*, *Impatiens capensis*, *Lobelia kalmii*, *Lycopus americanus*, *Medicago lupulina*, *Oenothera* sp., *Panicum capillare* as well as other invading grasses, *Polygonum convolvulus*, *P. lapathifolium*, *P. ramosissimum*, *Potentilla anserina*, *P. monspeliensis*, *Satureja glabella* var. *angustifolia*, *Trifolium hybridum*, *T. pratense*, and *Verbascum thapsus*. This list could be extended considerably by including species more than a meter or two from the line along which the profile was taken.

M. Bare rocks, washed by waves in 1949.

It must be remembered that this profile represents only one typical cross section of the island, and those plants apparent in early August. Near the tip of the northeastern arm, aquatic associations would have been evident, with *Scirpus acutus* in the water along with *Sagittaria latifolia* f. *gracilis;* on a muddy shore *S. latifolia*, *Potamogeton gramineus* var. *typicus*, and *Scirpus americanus;* then a zone of *Polygonum lapathifolium*. On the comparatively flat top of this arm *Fragaria virginiana* is abundant, with various shrubs and plants characteristic of the Great Lakes beaches. Thicket-formers besides *Cornus stolonifera* in different parts of the island are *Populus tremuloides*, *Betula papyrifera*, and *Thuja occidentalis*.

On August 20, 1948, a few minutes were spent on a smaller (unnamed) island a short distance west of Green Island and a part of the same shoal. To general appearances the vegetation was much the same, although not so varied. On this smaller island the largest plant was a fairly good-sized *Fraxinus pennsylvanica* var. *lanceolata*—much larger than those on Green Island. *Cornus stolonifera* formed tall and very dense thickets on the small island, and among the herbaceous species *Asclepias syriaca*, *Epilobium glandulosum* var. *adenocaulon*, *Impatiens capensis*, and *Potentilla anserina* were the most striking. Low spots along the south shore had extensive growth of *Typha latifolia* and *Phragmites communis* var. *berlandieri*.

The following plants occurring on Green Island appear not to have been reported from elsewhere in Mackinac County (Cf. "Literature Cited" for sources of previous references). Those marked with an asterisk have been mentioned in a previous paper (Voss, 1949).

Bidens frondosa
Eleocharis acicularis
Eleocharis elliptica
Equisetum variegatum
**Eupatorium perfoliatum*
Phragmites communis var. *berlandieri*
**Polygonum lapathifolium*
Potamogeton filiformis
Prunus serotina
**Salix interior*
Salix nigra
**Satureja acinos*
**Scutellaria epilobiifolia*

I am indebted to Dr. Rogers McVaugh for assistance in the determination of numerous specimens and criticism of the manuscript, and to Dr. Frank C. Gates for many helpful suggestions. Special thanks are also due Dr. C. R. Ball for examining most of the *Salix* material and Dr. F. J. Hermann for reviewing all the species of *Carex*.

SUMMARY

1. Green Island, approximately 600 by 45 meters, lies in the Straits of Mackinac (Mackinac County, Michigan) within half a mile of Pt. La Barbe, the nearest mainland.

2. Five collecting trips to the island produced a list of the vascular flora numbering 138 species and varieties, 13 of which do not appear to have been reported

from the mainland or from Mackinac Island (although they undoubtedly occur there).

3. Birds may have brought some seeds to the island, but human activities, wind, and water would account for most of the plants.

4. There is in most places a distinct zonation of vegetation depending largely on high and low water levels in the Straits, but well-developed plant associations are not marked. *Potentilla anserina* is the most abundant and widely distributed herb.

ANNOTATED LIST OF THE VASCULAR FLORA OF GREEN ISLAND

The nomenclature of the list follows primarily the *Flora of Kalamazoo County, Michigan*,[3] supplemented as necessary by the *Flora of Indiana*.[4] Species listed in neither of these volumes are named as in Gray's *Manual*.[5] The only exceptions to this system are indicated by reference either to literature or to the specialist who named the material.

Equisetaceae:

1. *Equisetum variegatum* Schleich.
   One carpet of several square meters.

Pinaceae:

2. *Juniperus communis* L. var. *depressa* Pursh.
3. *Juniperus horizontalis* Moench.
4. *Larix laricina* (Du Roi) Koch.
   Scarce, but one of the taller trees on the island.
5. *Picea glauca* (Moench) Voss.[6]
   Several taller trees toward the west end of the island, and one small one at the east end.
6. *Thuja occidentalis* L.
   Small trees frequent, forming conspicuous thickets in many places at the center of the island.

Typhaceae:

7. *Typha latifolia* L.
   Not common.

Potamogetonaceae:

8. *Potamogeton filiformis* Pers.
   In a pond at the southwestern edge of the island.
9. *Potamogeton gramineus* L. var. *typicus* Ogden.
   On the edges of the pond at the southwestern edge and also on muddy shores in the bay formed by the northeastern arm of the island.
10. *Potamogeton gramineus* L. var. *myriophyllus* Robbins.
    In the pond at the southwestern edge of the island.

Alismaceae:

11. *Sagittaria latifolia* Willd.
    At the pond at the southwestern edge and on muddy shores in the northeastern bay. Form *gracilis* (Pursh) Rob. occurs in shallow water at the latter location.

Gramineae (Poaceae):

12. *Agropyron dasystachyum* (Hook.) Scribn.
    In dryer spots; not common.
13. *Agrostis gigantea* Roth. (*A. alba*).
14. *Agrostis scabra* Willd.
15. *Elymus canadensis* L.
    One of the commonest grasses on the island.

---

[3]Clarence R. and Florence N. Hanes, Schoolcraft, Michigan, 1947.

[4]Charles C. Deam, Indianapolis, 1940.

[5]Seventh edition, by Robinson & Fernald, 1908.

[6]Cf. *Rhodora*, 17: 59 (1915).

16. *Hordeum jubatum* L.
17. *Panicum capillare* L.
    On rocky beaches; scarce.
18. *Phleum pratense* L.
19. *Phragmites communis* Trin. var. *berlandeieri* (Fourn.) Fern.
    Not common.
20. *Poa compressa* L.
    Common in dryer places.
21. *Poa pratensis* L.
22. *Sphenopholis intermedia* (Rydb.) Rydb.
    Around the pool at the southwestern edge.
23. *Phalaris arundinacea* L.

Cyperaceae:

24. *Carex garberi* Fern.
    Common.
25. *Carex hystricina* Muhl.
    Common.
26. *Carex stipata* Muhl.
    Scarce.
27. *Carex substricta* (Kükenth.) Mack.
    Very dense in some places along the shore.
28. *Carex viridula* Michx.
    Common.
29. *Carex vulpinoidea* Michx. var. *pycnocephala* Hermann.
30. *Eleocharis acicularis* R. & S.
    Forms small tufts on some of the sandy shores.
31. *Eleocharis elliptica* Kunth.
32. *Eleocharis palustris* (L.) R. & S.
33. *Scirpus acutus* Muhl.
    Abundant in the pool at the southwestern edge and along the edge of the bay formed by the northeastern arm.
34. *Scirpus americanus* Pers.

Juncaceae:

35. *Juncus alpinus* Vill. var. *rariflorus* Hartm.
    Common.
36. *Juncus balticus* Willd. var. *littoralis* Engelm.
    Abundant.
37. *Juncus nodosus* L.
38. *Juncus tenuis* Willd. var. *dudleyi* (Wieg.) Hermann.
    Scarce.

Liliaceae:

39. *Smilacina stellata* (L.) Desf.
    One small patch.
40. *Zigadenus glaucus* Nutt.
    Common in dry sand.

Iridaceae:

41. *Sisyrinchium montanum* Greene.[7] (*S. angustifolium*).
42. *Iris versicolor* L.
    Characters of both flowers and seeds place one clump of plants as this species.
43. *Iris virginica* L. var. *shrevei* (Small) Anderson.
    Not common.

Salicaceae:

44. *Populus balsamifera* L.
    Rather common.

[7]Cf. *Rhodora*, 48: 158 (1946).

45. *Populus tremuloides* Michx.
    Small trees are common and conspicuous.
46. *Salix bebbiana* Sarg.
47. *Salix bebbiana*×*candida*.
    Determined by C. R. Ball.
48. *Salix cordata* Michx.[8]
49. *Salix glaucophylloides* Fern. var. *brevifolia* (Bebb) Ball (ined.).
    Named by C. R. Ball.
50. *Salix interior* Rowlee.
    Very common, forming dense thickets of shoots.
51. *Salix lucida* Muhl.
52. *Salix nigra* Marsh.
    Abnormal growth, and possibly a hybrid. Determined by C. R. Ball.

Betulaceae:

53. *Betula papyrifera* Marsh.
    Several young trees.

Urticaceae:

54. *Ulmus americana* L.
    One small tree.

Santalaceae:

55. *Comandra richardsiana* Fern.
    Not widespread, but rather common at the extreme eastern end of the island. The plants have deep rootstocks.

Polygonaceae:

56. *Rumex crispus* L.
57. *Polygonum ramosissimum* Michx.
    In 1948, noticed only on a few sandy spots on the shore; in 1949, abundant on rocky shores as well.
58. *Polygonum convolvulus* L.
59. *Polygonum lapathifolium* L.
    Very common.

Chenopodiaceae:

60. *Chenopodium album* L.
    Found only near the water's edge in 1949, and apparently a new introduction to the island.

Caryophyllaceae:

61. *Arenaria serpyllifolia* L.
62. *Lychnis alba* Mill.

Ranunculaceae:

63. *Anemone cylindrica* Gray.
    Scarce.
64. *Anemone multifida* Poir.
    Common.
65. *Ranunculus acris* L.

Cruciferae (Brassicaceae):

66. *Barbarea vulgaris* R. Br.
67. *Brassica kaber* (DC) Wheeler var. *pinnatifida* (Stokes) Wheeler.
68. *Cakile edentula* (Bigel.) Hook.
69. *Capsella bursa-pastoris* (L.) Medic.
70. *Erucastrum gallicum* (Willd.) O. E. S.
    Rather common along the shores. A re-examination of material indicates that this is the species previously reported for the county (Voss, 1948) as *Diplotaxis muralis* (L.) Dc. from the St. Ignace Causeway.

---

[8] *S. cordata* Michx. (not Muhl.) replaces *S. syrticola* Fern. and *S. adenophylla* Hook., according to C. R. Ball.

71. *Erysimum cheiranthoides* L.
Apparently a new introduction in 1949; a very few plants at the water's edge.
72. *Rorippa islandica* (Oeder) Borbas var. *fernaldiana* Butters & Abbe.[9]

Crassulaceae:

73. *Sedum acre* L.
Several patches.

Grossulariaceae:

74. *Grossularia cynosbati* (L.) Mill.
Rather common.

Rosaceae:

75. *Amelanchier arborea* (Mich. f.) Fern.
Two clumps are probably this species.
76. *Fragaria virginiana* Duchesne.
Common throughout.
77. *Geum* sp.
One large incomplete plant.
78. *Malus pumila* Mill.
A few trees.
79. *Physocarpus opulifolius* (L.) Maxim.
80. *Potentilla anserina* L.
Abundant, and occurring in all situations except the wettest.
81. *Potentilla monspeliensis* L.
Common.
82. *Potentilla fruticosa* L.
83. *Prunus pumila* L.
Common.
84. *Prunus serotina* Ehrh.
Scarce.
85. *Prunus virginiana* L.
Scarce.
86. *Rosa blanda* Ait.
A few small unarmed shrubs may be this species.
87. *Rubus strigosus* Michx.
Forming thickets in some places.

Leguminosae (Fabaceae):

88. *Lathyrus japonicus* Willd. var. *glaber* (Ser.) Fern.
Common throughout.
89. *Medicago lupulina* L.
Not common.
90. *Trifolium hybridum* L.
91. *Trifolium pratense* L.
92. *Trifolium procumbens* L.
93. *Trifolium repens* L.

Anacardiaceae:

94. *Rhus radicans* L.
In only a few places.

Balsaminaceae:

95. *Impatiens capensis* Meerb.[10] (*I. biflora*).
Common in wet situations.

Hypericaceae:

96. *Hypericum perforatum* L.
Not common.

---

[9]Cf. *Rhodora*, 50: 100 (1948).
[10]Cf. *Rhodora*, 50: 205 (1948).

Eleagnaceae:

97. *Shepherdia canadensis* (L.) Nutt.
Scarce.

Onagraceae:

98. *Epilobium glandulosum* Lehm. var. *adenocaulon* (Haussk.) Fern.
Common.

99. *Oenothera* sp.
Numerous plants in the *biennis-muricata* alliance.

Umbelliferae (Ammiaceae):

100. *Cicuta bulbifera* L.
Scarce.

101. *Sium suave* Walt.
Scarce.

Cornaceae:

102. *Cornus stolonifera* Michx.
Very common. Perhaps brought by gulls; I have seen the birds eat the fruit from bushes on the shore of the Straits at Mackinaw City.

Oleaceae:

103. *Fraxinus pennsylvanica* Marsh. var. *lanceolata* (Borkh.) Sarg.
Not common, and small.

Asclepiadaceae:

104. *Asclepias syriaca* L.
Common throughout.

Labiatae (Lamiaceae):

105. *Lycopus americanus* Muhl.
Common in damper situations.

106. *Mentha arvensis* L.
Rather common. Some plants have pure white blossoms, although the majority have lilac ones.

107. *Nepeta cataria* L.
Scarce; one colony.

108. *Prunella vulgaris* L.
Two or three plants near the water line, 1949; evidently introduced that year.

109. *Satureja acinos* (L.) Scheele.
Several patches in dry, sandy ground.

110. *Satureja glabella* (Michx.) Briquet var. *angustifolia* (Torr.) Svenson.
Common along rocky shores.

111. *Scutellaria epilobiifolia* Hamil.
Not common.

Scrophulariaceae:

112. *Linaria vulgaris* Mill.
Common.

113. *Verbascum thapsus* L.
Rather common, and frequently very tall.

114. *Veronica americana* (Raf.) Schwein.
In damp sand; scarce.

Plantaginaceae:

115. *Plantago major* L.
A few plants on shore exposed in 1949, so probably came to the island that year. Not noticed previously.

Caprifoliaceae:

116. *Sambucus pubens* Michx.
Several young plants, perhaps brought by birds which had eaten the fruit.

Campanulaceae:

117. *Campanula rotundifolia* L. var. *intercedens* (Witasek) Farw.
Not common.

Lobeliaceae:

118. *Lobelia kalmii* L.
Rather common in damp places.

Compositae:

119. *Achillea millefolium* L.
Common.
120. *Anaphalis margaritacea* (L.) B. & H. var. *intercedens* Hara.
121. *Artemisia caudata* Michx.
Common.
122. *Aster junceus* Ait.
Common.
123. *Aster lindleyanus* T. & G.
124. *Bidens frondosa* L.
Rather common on wet shores.
125. *Cirsium arvense* (L.) Scop.
Common.
126. *Cirsium pitcheri* (Torr.) T. & G.
127. *Erigeron philadelphicus* L.
128. *Eupatorium maculatum* L.
129. *Eupatorium perfoliatum* L.
130. *Chrysanthemum leucanthemum* L. var. *pinnatifidum* Lecoq & Lamotte.
Very common.
131. *Hieracium aurantiacum* L.
Common.
132. *Hieracium canadense* Michx.
Scarce.
133. *Hieracium florentinum* All.
Common.
134. *Solidago altissima* L.
Common.
135. *Solidago ohioensis* Riddell.
136. *Solidago graminifolia* (L.) Salisb.
Common.
137. *Tanacetum huronense* Nutt.
138. *Taraxacum officinale* Weber.

LITERATURE CITED

All the species in the preceding list except the thirteen to which attention was previously called have been reported specifically for Mackinac County in one or more of the following publications. These include the major lists of Mackinac County plants and such other studies as cite Mackinac County specimens of species reported in this paper and not included in the major lists.

Dodge, C. K. "The Flowering Plants, Ferns and their Allies of Mackinac Island." *Fifteenth Rep. Mich. Acad. Sci.* (1913): 218–237, plus addenda sheet (2 pp.). 1913.

Dodge, C. K. "Observations on the Flowering Plants, Ferns, and Fern Allies on and near the Shore of Lake Huron from Linwood Park near Bay City, Bay County, to Mackinaw City, Cheboygan County, Including the Vicinity of St. Ignace, Mackinac and Bois Blanc Islands, Mackinac County." Mich. Geol. & Biol. Surv. Publ. 31 (Biol. Series 6): 15–74. 1921.

Hermann, Frederick J. "The Genus Carex in Michigan." *Amer. Midl. Nat.*, 25: 1–72. 1941.

Ogden, E. C. "The Broad-leaved Species of Potamogeton of North America, North of Mexico." (Continuation) *Rhodora*, 45: 119–163. 1943.

Potzger, J. E. "The Vegetation of Mackinac Island, Michigan: An Ecological Survey." *Amer. Midl. Nat.*, 25: 298–323. 1941.

Potzger, J. E. "The Vegetation of Round Island (Straits of Mackinac), Michigan." *Butler Univ. Bot. Studies*, 6: 116–122. 1944.

Robertson, Betty M. "Distribution of the Ranunculaceae in Michigan." *Papers Mich. Acad. Sci., Arts, & Letters*, 26 (1940): 31–59. 1941.

Voss, Edward G. "Observations on the Michigan Flora: A Survey of the St. Ignace Causeway (Mackinac County)." *Denison Univ. Bull., Jour. of the Sci. Lab.*, 41: 39–45. 1948.

Voss, Edward G. *Ibid.*, II: "Some Plants New or Rare in Emmet, Cheboygan, and Mackinac Counties, Michigan." *Ibid.*, 41: 77–81. 1949.

ANNUAL REPORT OF THE OHIO ACADEMY OF SCIENCE

1950

Organized 1891 Incorporated 1892

Affiliated with the American Association for the Advancement of Science

OFFICERS AND COMMITTEES FOR 1950–1951

President

EDWARD S. THOMAS

Vice-Presidents

A. *Zoology:* G. D. MORGAN
B. *Plant Sciences:* C. C. ALLISON
C. *Geology:* J. O. FULLER
D. *Medical Sciences:* C. A. ANGERER
E. *Psychology:* C. O. MATHEWS
F. *Physics and Astronomy:* H. V. KNORR
G. *Geography:* H. F. RAUP
H. *Chemistry:* G. L. ORR
I. *Mathematics:* C. H. HEINKE
J. *Science Education:* HARLEY ELLINGER
K. *Anthropology and Sociology:* K. H. WOLFF

Secretary

RUSH ELLIOTT

Treasurer

R. M. GEIST

Historian

W. H. ALEXANDER

COMMITTEES

Executive Committee

Ex-Officio: E. S. THOMAS, RUSH ELLIOTT, R. M. GEIST

Elective: G. B. BARBOUR, G. W. BLAYDES

Membership

A. *Zoology:* A. N. SOLBERG, Chairman
B. *Plant Sciences:* F. J. BACON
C. *Geology:* C. N. SAVAGE
D. *Medical Sciences:* E. R. HAYES
E. *Psychology:*
F. *Physics and Astronomy:* A. L. LUTZ
G. *Geography:* L. R. FLETCHER
H. *Chemistry:* B. M. NORTON
I. *Mathematics:*
J. *Science Education:* C. T. HATHAWAY
K. *Anthropology and Sociology:* E. L. REYNOLDS

Nominating

VICE-PRESIDENTS OF 1949–1950, R. J. BERNHAGEN, Chairman

Program

VICE-PRESIDENTS OF SECTIONS AND SECRETARY

Library

MRS. MARGARET MCCARTNEY, Chairman
R. A. HEFNER.....Term expires 1951
W. M. TIDD.....Term expires 1953

Publications

SECRETARY, Chairman
R. A. HEFNER.....Term expires 1951
W. M. TIDD.....Term expires 1953

Conservation

E. S. THOMAS.....Term expires 1951
P. B. SEARS.....Term expires 1951
F. J. WRIGHT.....Term expires 1951
J. R. BECK, Chairman.....Term expires 1952
R. A. HEFNER.....Term expires 1952
E. L. RICE.....Term expires 1952
R. W. DEXTER.....Term expires 1953
R. W. FRANKS.....Term expires 1953
L. S. ROACH.....Term expires 1953

Necrology

KARL VER STEEG.....Term expires 1951
H.H.M.BOWMAN, Chairman. Term expires 1952
RODERICK PEATTIE.....Term expires 1953

Resolutions

W. C. BEAVER, Chairman...Term expires 1951
H. R. EGGLESTON.....Term expires 1952
A. W. LINDSEY.....Term expires 1953

Trustees of Research Fund

E. N. TRANSEAU, Chairman, Term expires 1951
HERBERT O. OSBORN.....Term expires 1952
G. B. BARBOUR.....Term expires 1953

Academy Representatives

1. On the Joint Administrative Board of the Ohio Journal of Science:
   R. A. Hefner.....Term expires 1951
   W. M. Tidd.....Term expires 1953
2. On the Council of the A. A. A. S.: Rush Elliott.

The Council for 1950–1951

C. C. Allison	L. R. Fletcher	F. H. Krecker	H. F. Raup
C. A. Angerer	J. O. Fuller	A. L. Lutz	E. L. Reynolds
F. J. Bacon	R. M. Geist	Mrs. Margaret McCartney	C. N. Savage
G. B. Barbour	E. R. Hayes	C. O. Mathews	A. N. Solberg
J. R. Beck	C. T. Hathaway	G. D. Morgan	E. S. Thomas
G. W. Blaydes	R. A. Hefner	B. M. Norton	W. M. Tidd
Harley Ellinger	C. L. Heinke	G. L. Orr	E. N. Transeau
Rush Elliott	H. V. Knorr	R. A. Popham	K. H. Wolff

REPORT OF THE FIFTY-NINTH ANNUAL MEETING OF THE OHIO ACADEMY OF SCIENCE

As a part of the centennial program of Capital University, the Academy was invited to meet on the campus of Capital and to enjoy the facilities of the new Science Hall. The meetings were held on April 27, 28, and 29. The local committee, under the chairmanship of Dr. R. M. Geist, had made splendid provision for all needs. The registration for the meeting hit an all-time high and the quality of the meetings seems to be improving each year.

Each section of the Academy had a good program and one of the outstanding features of the meeting was the second Annual Science Day of the Junior Academy. This project has developed very rapidly and is proving to be an extremely valuable part of the program of The Senior Academy.

The annual banquet and business meeting was held in the Refectory at Capital University on Friday evening at 6:45. Dr. R. M. Geist served as toastmaster, greetings for the host institution were extended by President Harold L. Yochum and the response was given by Dr. E. L. Rice. The presidential address was given by Dr. Paul B. Sears on the title, "Conservation in Theory and Practice."

The annual report of the past year's activities presented by the secretary included a most gratifying membership report. Last year we had passed the 1000 mark in our total membership. This year we were seven members short of the 1200 mark. Two hundred sixty-one new members were added in the past year—an all-time record for a single year. Unfortunately we loose some members each year.

The following persons were announced as newly elected Fellows of the Academy:

Robert L. Alkire	Paul W. Hydell	Conrad E. Ronneberg
K. Dale Archibald	Ruth W. Hershberger	Julia E. Rothermel
Clifford O. Berg	R. George Jaap	Carleton N. Savage
A. H. Blickle	Lowry B. Karnes	James M. Schopf
William F. Bradley	Arthur S. Kiefer	G. T. Scott
A. B. Brower	Aurele La Rocque	Frank M. Semans
Thomas B. Cameron	Ian R. MacGregor	Paul J. Seyler
James F. Corwin	Richard H. Mahard	George T. Siemens
George Crowl	Frank G. Meserve	George E. Simpson
W. Merrill Davis	Dorothy Clum Morse	Elizabeth W. Smith
Clarence L. Dow	Everett C. Myers	William D. Stull
Erika Eichorn	Stanley E. Norris	Henry F. Strohecker
Henry C. Eyster	Bayes M. Norton	Charles Summerson
Henry Federighi	L. C. Pettit	Charles M. Vaughn
Allen S. Fox	John R. Randall	Jacob Verduin
William D. Gray	Earle L. Reynolds	Herman Von Dach
C. T. Hathaway	John S. Richardson	John W. Wargo
Gale A. Herbert	William L. Robinson	Clair L. Worley

The report of the Nominating Committee was presented by Dr. E. T. Bodenberg, of the Necrology Committee by Dr. J. E. Carmen, and of the Resolutions Committee by Dr. W. C. Beaver.

Respectfully submitted,
Rush Elliott, *Secretary.*

REPORT OF THE EXECUTIVE COMMITTEE AND COUNCIL

The Executive Committee met on December 9, 1949, and again on April 27, 1950, and the Council on December 10, 1949, and again on April 27, 1950.

A special committee (Eugene Van Cleef, Chairman, F. H. Krecker and A. W. Lindsey) appointed to consider methods of increasing the income of the Academy and the allocation of the funds collected had reported at the Council meeting on April 21, 1949. This report contained a number of recommendations which required constitutional amendments. These were prepared by the secretary, as instructed, were approved by the Executive Committee, by vote of the Council, and final approval was voted by the Academy members in attendance at the annual business meeting. One of these amendments increased the annual dues to $3.00. Another provided for Institution Memberships for colleges and Universities and twelve such memberships have been secured to date. A third type of membership is Corporation Membership and four Corporations have taken memberships to date.

The Council accepted with deep regret the resignation of Dr. Herbert O. Osborn as Chairman of the Trustees of the Research Fund and of Miss Lillian Michaelis as Librarian for the Academy.

The 1951 annual meeting is to be held at Miami University on April 5, 6, and 7.

Respectfully submitted,
RUSH ELLIOTT, *Secretary.*

REPORT OF THE TREASURER

COLUMBUS, OHIO, April 28, 1950.

To the Ohio Academy of Science:

I herewith submit a financial statement of the condition of the Ohio Academy of Science as of December 31, 1949. The books have been audited and the auditor's certificate is herewith attached.

Respectfully submitted,
R. M. GEIST, *Treasurer.*

OHIO ACADEMY OF SCIENCE BALANCE SHEET
As at December 31st 1949
ASSETS

CURRENT EXPENSE FUND:		
Cash in Bank		$ 687.77
Bonds Owned:		
U. S. War Savings Bonds—Series F (cost)	$ 111.00	
U. S. War Savings Bonds—Series G (cost)	1,900.00	
Total Bonds Owned		$2,011.00
Total Assets—Current Expense Fund		$2,698.77
RESEARCH FUND:		
Cash in Bank	$ 224.84	
Bonds Owned:		
Fort Hayes Hotel—Columbus, Ohio (cost)	$1,300.00	
U. S. War Savings Bonds—Series G (cost)	300.00	
Total Bonds Owned	1,600.00	
Banc-Ohio Securities Company Stock	437.50	
Total Assets—Research Fund		2,262.34
Total Assets		$4,961.11

LIABILITIES AND NET WORTH

LIABILITIES:		
CURRENT EXPENSE FUND:		
Deferred Credits to Dues—		
1950 Dues Paid in 1949		$ 47.50
NET WORTH:		
Ohio Academy of Science:		
Current Expense Fund	$2,651.27	
Research Fund	2,262.34	
Total Net Worth		4,913.61
Total Liabilities and Net Worth		$4,961.11

OHIO ACADEMY OF SCIENCE STATEMENT OF INCOME AND EXPENSE
For the Year Ended December 31, 1949
CURRENT EXPENSE FUND

INCOME:		
Membership Dues 1949 and Prior Years		$2,362.50
Sale of Publications		46.55
Interest on Bonds		47.50
Refunds—Surety Bond		.89
Total Income		$2,457.44
EXPENSES:		
Subscriptions—Ohio Journal of Science	$1,326.00	
Printing Proceedings 1949	$ 107.90	
Printing—Office Supplies	156.51	
Printing—Other	309.28	
Total Printing Expense	573.69	
Honorarium—Secretary	160.00	
Postage, Telephone and Office Expense	89.15	
Bank Charges	20.45	
Auditing	25.00	
Bond—Treasurer	5.00	
Total Expenses		2,199.29
Excess of Income Over Expense		$ 258.15

RESEARCH FUND

INCOME:		
Grants for Research A.A.A.S.		$ 236.25
Interest on Bonds		65.75
Dividends Received		12.50
Total Income		$ 314.50
EXPENSES:		
Grants for Research	$ 309.18	
Plates for Knull Article—Ohio Journal of Science	17.27	
Bank Charges	2.32	
Total Expenses		328.77
Excess of Expense Over Income		$ 14.27

AUDITOR'S CERTIFICATE

COLUMBUS, OHIO, April 1, 1950.

The Ohio Academy of Science, Columbus, Ohio.

GENTLEMEN:

Pursuant to your instructions, I have examined the accounts and records of the Treasurer of the Ohio Academy of Science for the year ended December 31, 1949.

A detailed audit was made of all transactions handled by the Treasurer. Cash in bank was verified by bank certification. Securities in safety deposit box were verified by personal examination. My examination was made in accordance with generally accepted auditing standards.

In my opinion, the accompanying balance sheet and statements of income and expense (cash basis) fairly represent the financial position as at December 31, 1949, and the results of operations on a cash basis for the year ending December 31, 1949. These statements are in conformity with generally accepted accounting principles.

Respectfully yours,
D. M. SHONTING,
Certified Public Accountant.

REPORT OF THE TRUSTEES OF THE RESEARCH FUND

COLUMBUS, OHIO, April 27, 1950.

To the Ohio Academy of Science:

The Trustees of the Research Fund present the following Report on the receipts and expenditures during the year 1949:

RECEIPTS:

Bank Balance on January 1, 1949	$239.11
Received from the A. A. A. S.	236.25
Received from Investments	78.25
Total Income	$553.61

EXPENDITURES:

March 30—To Joseph R. Stratton, University of Toledo, for establishing and maintaining an experimental colony of guinea-pigs	$ 48.00
August 6—To John F. Hopkins, Oberlin College, for aid in collecting peat samples in Canada	236.18
August 6—To Joseph Knull, Ohio State University, for illustrations in the Ohio Journal of Science	17.20
December 20—To Ralph Dexter, Kent State University, for field study of Fairy Shrimps	25.00
Bank Charges	2.39
Total Expenditures	$328.77
Bank Balance on January 1, 1950	$224.84

There will therefore be several hundred dollars available for research aid during this year.

Respectfully submitted,
E. LUCY BRAUN,
HERBERT OSBORN,
E. N. TRANSEAU, *Chairman.*

REPORT OF THE LIBRARY COMMITTEE

Nine new exchanges were added to the list in 1949. Two were dropped for failure to send anything in return. The Business Manager removed most of the Chinese addresses which remained, because of postal problems.

Sale of publications amounted to $46.55. That amount has been turned over to the Treasurer of the Academy.

Respectfully submitted,
LILLIAN MICHAELIS, *Librarian.*

REPORT OF THE JOINT ADMINISTRATIVE BOARD OF THE OHIO JOURNAL OF SCIENCE

A special meeting of the Joint Administrative Board of the Ohio Journal of Science was held in Columbus, Ohio, October 15, 1949. Those present were Drs. Spieker and Meyer representing the Ohio State University; Drs. Hefner and Tidd representing the Ohio Academy of Science; and Drs. Blaydes and Popham representing the Ohio Journal of Science.

Dr. Popham presented facts and figures concerning the financial status of the Journal. Following this report, the Board voted to increase the subscription rate of the Journal to $4.00 per year, effective as soon as practicable. The price of all back issues of the Journal was set at $1.00 per copy, and the price of all back volumes was set at $4.00 per volume. The Business Manager was authorized to accept advertising for the Journal, the details of rates and kinds of advertising to be left to the discretion of the Business Manager.

The Board requested that the Council of the Ohio Academy of Science deposit a copy of the minutes of its meetings with the secretary of the Joint Administrative Board of the Journal. The Editor of the Journal was directed to contact the Vice-President of each section of the Academy each year, and to encourage him to secure papers from his own field of science for publication in the Journal.

Dr. Spieker made a progress report concerning the selection of the new Editor for the Journal. A discussion followed.

There being no further business, the Board was adjourned.

Respectfully submitted,
RICHARD A. POPHAM,
Secretary of the Board.

REPORT OF THE JOINT ADMINISTRATIVE BOARD OF THE OHIO JOURNAL OF SCIENCE

The annual meeting of the Joint Administrative Board of the Ohio Journal of Science was held in Columbus, Ohio, April 25, 1950. Those present were Drs. Spieker and Meyer representing the Ohio State University; Dr. Tidd representing the Ohio Academy of Science; and Drs. Blaydes, Popham, and Bohning representing the Ohio Journal of Science. Dr. Hefner, an Academy representative, was unable to attend.

Following the election of Dr. Spieker as Chairman of the Board, the minutes of the preceding meeting were read and approved.

Dr. Blaydes was elected to serve as Editor for Volume 50 of the Journal. Dr. Popham was elected Business Manager, and Dr. Bohning was elected Advertising Representative. The Board authorized the Editor to appoint an Associate Editor, in charge of book reviews, and recommended that the number of book reviews per volume be increased.

The report of the Business Manager was mainly in the form of a financial statement for Volume 49, a copy of which is attached to this report. The Editor, Dr. Blaydes, reported that a total of 41 papers covering 252 pages, were published in Volume 49. The papers were contributed from 13 different fields of science. Five book reviews were also printed. There were 15 manuscripts on hand at the end of the year. Both reports were accepted and filed.

Dr. Bohning presented an informal report of the Advertising Representative, indicating that 289 companies have been contacted regarding the placing of ads in the Journal. He reported that ads had been obtained from 11 companies and that many have asked to be contacted in the fall, at which time they will determine their 1951 advertising budgets. He also called attention to the fact that the cost of securing advertising was very high, and that to date the Journal had not realized a net profit from this operation.

The Board established a policy of electing the Vice-Presidents of the various sections of the Academy to positions as members of the Editorial Board for the period of their service as Vice-Presidents.

The Editor once again asked that the section Vice-Presidents of the Academy be on the alert during their programs for papers suitable for publication in the Journal. The Editor requested that such titles and authors be referred directly to him by the section Vice-Presidents.

There being no further business, the Board adjourned.

Respectfully submitted,

RICHARD A. POPHAM,
Secretary of the Board.

THE OHIO JOURNAL OF SCIENCE

Fiscal Year 1949

RECEIPTS

Bank Balance, Feb. 23, 1949	$ 238.87
Ohio State University—Paid for Subscriptions	1,300.00
Ohio Academy of Science—Paid for Subscriptions	1,390.50
Non-members—Paid for Subscriptions	152.50
Sale of Separate Numbers, Volumes, and Reprints	518.22
Authors—Paid for Plates	152.88
Ohio Academy of Science—Paid for Annual Report	107.90
Authors and Institutions—Paid for Printing	100.00
	$3,960.87

EXPENDITURES

Spahr & Glenn—Printing Journal	$3,003.30
Spahr & Glenn—Mailing Envelopes	82.60
Bucher Engraving—Plates	295.59
Postage and Express	187.95
Office Supplies and Bank Charges	151.31
Refunds	2.50
Secretary and Labor	38.70
Bank Balance, Jan. 18, 1950	198.92
	$3,960.87

REPORT OF THE COMMITTEE ON CONSERVATION

The Conservation Committee held two meetings during the past year to plan appropriate activities and to discuss conservation matters relating to the Academy. Both meetings were held at Columbus, Ohio, on December 10, 1949, and February 4, 1950, respectively. The Committee following its December 10th meeting recommended to the Council that the Ohio Academy of Science conduct a symposium on conservation at the annual meeting and that the Academy express to the Director of the newly created Ohio Department of Natural Resources support in the development of an effective conservation program in the state. Both recommendations were approved by the council and have been put into effect, the former by the symposium planned for presentation at 4:15 P. M. Friday, April 28, in Troutman Hall, Capital University, and the latter by an appropriate letter from the Secretary to Mr. A. W. Marion, Director of the Department of Natural Resources.

The Committee in planning this first conservation symposium felt that it should logically be the fore-runner of a series of such symposia designed to acquaint the membership of the Academy with conservation problems, programs and progress in the state. The first symposium is planned to present an over-all picture of the organization of the Department of Natural Resources created by Amended Senate Bill Number 13 passed by the last General Assembly of the State of Ohio and of the water and geological survey division of that department. It is the hope and recommendation of the Committee that similar symposia be held in subsequent years on other aspects of conservation.

The Committee also plans to hold an informal discussion with a group of persons concerned with education administration to consider an approach to the large problems of developing a significant program of conservation education in the public schools of the State. This meeting is tentatively planned for mid-May of this year.

The Committee feels that the Ohio Academy of Science has an opportunity to be of real service to the conservation program of the state through offering appropriate leadership and guidance. To this end it is our belief that the Committee could be made more effective if its membership included representatives of all the fields directly concerned with resource management. We, therefore, recommend that an effort be made through subsequent appointments to the Committee to see that adequate representation is given to the fields of soil, water, forest, mineral and wildlife conservation.

Respectfully submitted,

R. V. Bangham, E. L. Rice,
James R. Beck, P. B. Sears,
R. W. Franks, E. S. Thomas,
R. A. Hefner, Frank J. Wright,
Charles A. Dambach, *Chairman.*

REPORT OF THE COMMITTEE ON NECROLOGY

The Committee on Necrology reports with deep regret the death of five members of the Academy since the last annual meeting. The following memorial statements were written by colleagues of the deceased members as indicated by the name following each statement.

Respectfully submitted,

H. H. M. Bowman
Karl Ver Steeg
J. Ernest Carman, *Chairman.*

Edmund Secrest

Dr. Edmund Secrest, director of the Ohio Agricultural Experiment Station from 1937 to 1947 and former State Forester, died November 28, at Ford Hospital in Detroit following a brain operation. He was 68.

Dr. Secrest was known as the father of forestry in Ohio. The present forestry program, which has created thousands of acres of state owned land, was developed under his personal direction. Several months ago he was named chairman of the new forestry research department at the Station when the Division of Forestry was transferred to the new Ohio Department of Natural Resources. Dr. Secrest was also a member of the Ohio Strip Mine Commission.

Dr. Secrest was born at Randolph, Kansas, and was a graduate of Kansas State College. He was awarded honorary doctor of science degrees by the Kansas State College and the College of Wooster. At the time of his death he was serving as a member of the board of trustees of the College of Wooster. He was a member of the Society of American Foresters, the Association of State Foresters, the Ohio Academy of Science, and the Ohio Forestry Association.

During his years in forestry in Ohio, Dr. Secrest was the author of several bulletins, presented numerous speeches on forestry before technical and other groups, and was the author of the statutes of the general code of Ohio relating to forestry.

He is survived by his wife and two daughters, Mrs. Mary Hoover Shibley, of Lakewood, and Edith, a student in Philadelphia. Burial was made in the Wooster, Ohio, cemetery.

—*O. D. Diller.*

John A. Toomey

Dr. John A. Toomey died of cerebral hemorrhage in Cleveland City Hospital on New Year's Day, 1950. Born in Cleveland in 1889, his entire life was spent in his native city. He received from St. Ignatius College an A. B. degree in 1910, and a Master's degree in 1912. After acquiring an LL.B. degree from the Cleveland Law School in 1913, he decided to enter the profession of medicine, and graduated from the Western Reserve University Medical School in 1919. In 1949 he received an honorary LL.D. from John Carroll University.

At the time of his death he was Professor of Clinical Pediatrics and Contagious Diseases at Western Reserve University, having served his Alma Mater as chief of the City Hospital Contagious Diseases and Pediatrics Division for 29 years.

He was a member of many scientific and professional societies including the Ohio Academy of Science, the American Academy of Pediatrics (president 1949), the American Pediatrics Society, the Society of American Bacteriologists, the American Medical Association, the Ohio State Medical Society and the Cleveland Academy of Medicine.

He served his local medical society with great distinction as a member of the Board of Directors and as chairman of several scientific divisions of the Academy, including the Pediatric, Practice of Medicine and Experimental Medical sections. In 1947–48 he was president of the Western Reserve University Medical Alumni Association. Although Dr. Toomey gave generously of his time in service to these various organizations, his greatest achievements were attained as a scientist, a teacher, and a medical consultant.

As a scientist his interest was devoted to fundamental problems in the epidemiology, immunology, and therapy of contagious diseases. Among his 350 published papers, 143 were devoted to his researches and clinical observations on poliomyelitis and he was among America's greatest students of this disease. His basic observation that the chief portal of this specific virus into the body is by way of the gastrointestinal tract has been accepted as a proven fact. This work remains as his greatest scientific discovery. Likewise by developing many original methods of therapy in poliomyelitis he was able to diminish the mortality and to lessen complications in his patients to a degree not hitherto reached.

As a teacher he excelled because of his broad knowledge of contagious diseases. His clear, colorful and practical method of presenting his subject was a great inspiration to all of his students. His exceptional ability as an instructor gained him the highest respect of all of his professional colleagues.

As a consultant, as well as a scientist and teacher, he possessed three important attributes of character—he had a broad sympathy for the patient, he was a hard and diligent worker, and he was honest. This combination of virtues made him a tower of strength to the patient and his relatives as well as to the family physician.

Honoring his memory, the Unit for Contagious Diseases at the Cleveland City Hospital has been named the "Toomey Pavilion." An editorial in the Cleveland *Plain Dealer* of January 3, 1950, expresses the high regard that Dr. Toomey held in the hearts of Cleveland citizens: "If there was a fighter of heroic proportions against that enemy of mankind, contagious disease, that fighter was John A. Toomey. By his death this city has lost one of its greatest citizens, one of its greatest native sons, a man whose fame in the profession of medicine extended the world around."

The death of Dr. John A. Toomey is of immeasurable loss to his patients and to his dear friends and colleagues.—*Dr. John Tucker.*

Marvin Pittman

Marvin Pittman, born April, 1919, at New Iberia, Louisiana, received the B. S. degree from Duke University, 1940, and the M.S. in Geography at the University of Chicago, 1946.

He served as bomber pilot and navigator during the war and was shot down over Germany. He was twice captured and twice escaped from German prison camps. He became part of the Jugoslav underground, and was picked up by the Russians near Vienna near the close of the war.

During the year 1948–49 Mr. Pittman was Assistant Professor of Geography at Miami University. He then joined the faculty of the University of the Philippines. During the Christmas holidays of 1949, Pittman and another Professor at this University went on a tramping trip into the Igorot County, Ifugao subprovince. On Christmas day, 95 km. north of Baguio, the two men were speared to death by a band of Ifugao headhunters. Pittman is survived by his wife and infant daughter, and by his parents at Statesboro, Georgia.

—*W. H. Shideler.*

Leslie L. Pontius

In the death of Leslie L. Pontius, Ohio lost one of its outstanding field naturalists. He was born in Tarlton, Pickaway County, Ohio, where he spent his boyhood and received his education in the village school.

Mr. Pontius taught for several years in the rural schools of Pickaway County and later was engaged in the drug business in Columbus. In 1913 he entered the Postal Service in Cir-

cleville, Ohio, where he remained for more than thirty years and at the time of his retirement was Assistant Postmaster.

He had a general knowledge of, and enjoyed all forms of Natural History. Although having no specialized training in botany he had a vast knowledge of what grows in the fields and woods and on the hills of Ohio. He could recognize without a moment's hesitation many of the plants that grow in the state. Working with his farmer friend and field companion, Mr. Floyd Bartley of near Circleville, many new records have been added to the list of Ohio plants. Mr. Pontius is known throughout the state as one of its outstanding field botanists. Plants collected by him can be found in many Universities and Museums, including Smithsonian Institute at Washington, D. C., and New York Botanical Gardens with which he was a collaborator. His entire herbarium has been placed at Ohio University at Athens, Ohio.

Mr. Pontius was an active member of many societies, including the Ohio Academy of Science, Wheaton Club, Audubon Society, Wilson Ornithological Society and the local Garden Clubs. He was an active member and Trustee of the First Methodist Church in Circleville, and will long be remembered by his many friends for his good judgment and understanding of people.—*Floyd Bartley.*

John Paul Visscher

John Paul Visscher, professor of biology in Western Reserve University, a distinguished teacher and a leading authority on the general physiology and behavior of the lower organisms, died on February 11, 1950.

For more than twenty-five years Professor Visscher's life and work exerted a profound influence on the teaching of biology in the University and through his students in the city and northern Ohio. During this time he carried on an active interest in research on marine animals and contributed widely to the local associations interested in biological subjects.

Dr. Visscher was born in Holland, Michigan, September 19, 1895, and was graduated from Hope College, Holland, with the B.A. degree in 1917. He promptly enlisted in the Army, Chemical Warfare Service, and was discharged as a second Lieutenant in December, 1918. On leaving the Army, he continued his studies in biology at the John Hopkins University, completing work for the M.A. degree in June, 1920. After two years as instructor in zoology, Washington University, St. Louis, he returned to John Hopkins in 1922 as Bruce Fellow and received his Ph.D. degree in 1924. During the summer months of his training period, Dr. Visscher carried on research on barnacles at the Marine Biological Laboratory, Woods Hole, resulting in a series of publications on the physiology and life cycle of Cirripedia. In connection with this work he studied marine life at the biological stations of Naples, Italy; in the Laboratory of the Marine Biological Association of the British Empire, Plymouth; in the Marine Station of the Dry Tortugas; and in the Pearl Harbor Naval Station.

Appointment to the Biology Department at Western Reserve University in 1924 to work with Professor Herrick, introduced the next important phase of Dr. Visscher's work. The work under way in the department in the field of Ornithology received his full support and resulted in the Baldwin Bird Research Laboratory and contributed to the establishment of a strong active society for the study of bird life in the city of Cleveland.

Dr. Visscher's accomplishments, his quality of mind and character, gained for him wide recognition and many honors. He was elected a member of the American Society of Naturalists; American Society of Zoologists; Fellow of American Association for the Advancement of Science; Fellow, Ohio Academy of Science; Sigma Xi; and Phi Beta Kappa. He served as a trustee of the Cleveland Museum of Natural History and the Garden Center of Greater Cleveland. He served as President of the Cleveland Bird Club for two terms and as president of the Wild Flower Club of Cleveland.—*Franklin J. Bacon.*

REPORT OF COMMITTEE ON RESOLUTIONS

Be it Resolved, that the members of the Ohio Academy of Science express to President Harold L. Yochum of Capital University, and to the members of the local committee, their appreciation of the hospitality so freely extended and the fine facilities furnished, which have made our fifty-ninth annual meeting so successful and pleasant.

Be it Resolved, that the Ohio Academy of Science express to President Yochum and the faculty of Capital University, its felicitations on the one-hundredth anniversary of this notable and distinguished institution of learning.

Be it further Resolved, that the Ohio Academy of Science record its deep appreciation for the devoted services of Dr. Herbert Osborn who is retiring as Chairman of the Trustees Research Fund after many years of membership in that committee, and for his numerous contributions to our organization in general, and to the field of science in the world at large.

Respectfully submitted,

P. B. Sears,
H. R. Eggleston,
W. C. Beaver, *Chairman.*

GOOD PRINTING

The Refuge of All the Arts against the Ravages of Time

HERE, in this shop for 93 years, our craftsmen have been preserving on the printed page, the works and discoveries of the educator and scientist. No job is too small, no job too difficult. Accents for all languages. Every word, every accent verified by proof.

ADams 8955

THE SPAHR & GLENN CO.

Monotype Composition Exclusively

FIFTY EAST BROAD STREET, COLUMBUS 15, OHIO

Microscope Repairing . ALL TYPES

AUTHORIZED BY AMERICAN OPTICAL COMPANY

Binocular Repairing . . ALL MAKES

AUTHORIZED BY LEADING MANUFACTURERS

Binoculars For Sale

AUTHORIZED BAUSCH & LOMB DEALERS

Pick-up and Delivery Service

R. H. BURTON COMPANY

327 EAST LONG STREET, COLUMBUS 15, OHIO

ADams 1645